PB82-241613

Guidelines for Air Quality Maintenance Planning and Analysis. Volume 5 Case Studies in Plan Development

(U.S.) Environmental Protection Agency
Research Triangle Park, NC

Dec 74

**U.S. Department of Commerce
National Technical Information Service
NTIS**

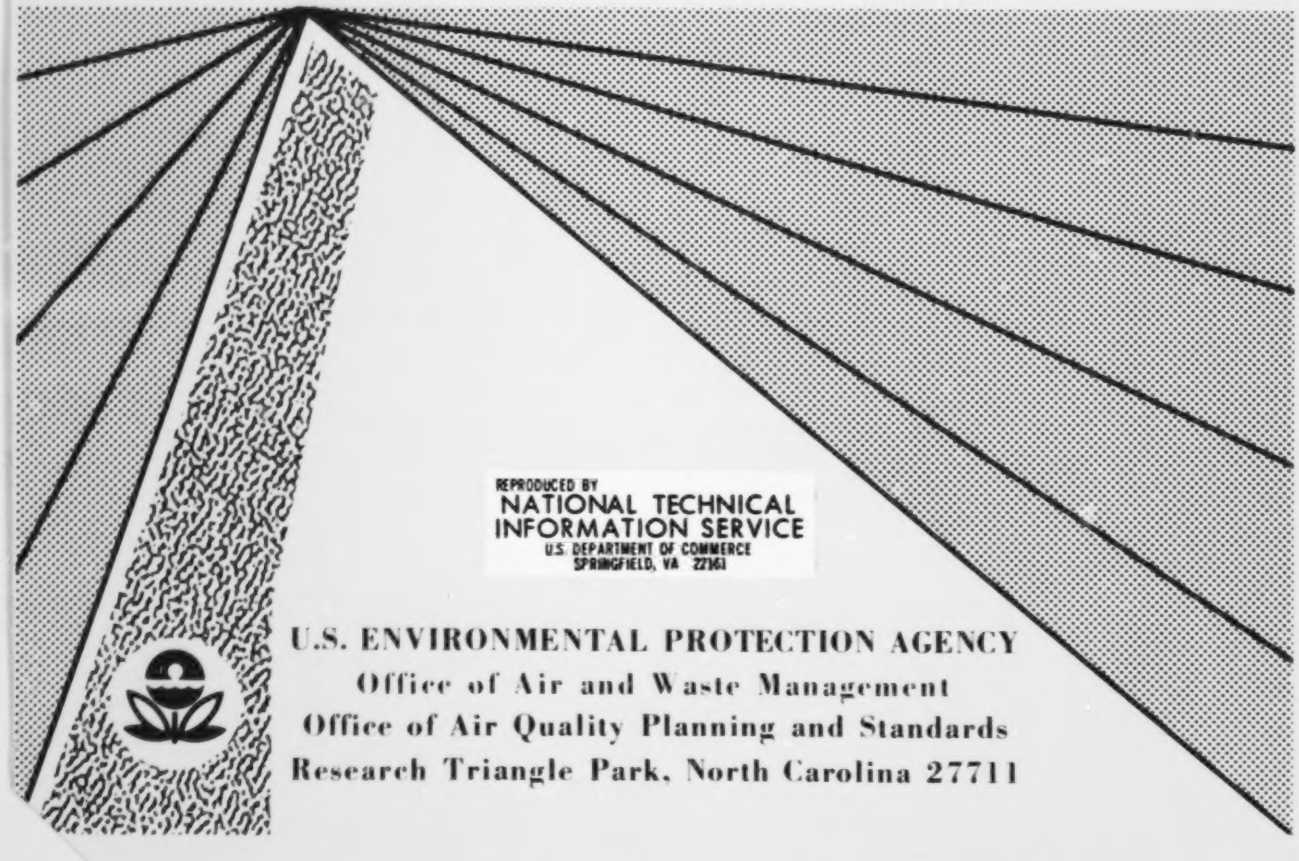
PB82-241613

EPA-450/4-74-006
DECEMBER 1974
(OAQPS NO. 1.2-024)

GUIDELINES FOR AIR QUALITY MAINTENANCE PLANNING AND ANALYSIS

VOLUME 5 :

CASE STUDIES IN PLAN DEVELOPMENT



REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA 22161

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-450/4-74-006	2.	3. RECIPIENT'S ACCESSION NO. PB82 241613
4. TITLE AND SUBTITLE Guidelines For Air Quality Maintenance Planning and Analysis. Vo..5: Case Studies in Plan Development		5. REPORT DATE December 1974 6. PERFORMING ORGANIZATION CODE 196012
7. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Environmental Protection Agency Office of Air and Waste Management Office of Air Quality Planning and Stndards Research Triangle Park, North Carolina 27711		13. TYPE OF REPORT AND PERIOD COVERED 14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES		

16. ABSTRACT

This document presents the digests of four full text trial Air Quality Maintenance Plans from San Diego, St. Louis, Baltimore, and Denver. The subjects covered in each trial are: characteristics of the study aress,intergovernmental cooperation, baseline emissions inventory, emissions projections, baseline air quality, air quality projections, selection of maintenance strategies, and legal authority. The trial AQMPs prepared during this study represent exercises to demonstrate administrative and technical procedures available and do not necessarily constitute final, acceptable plans. Many tables.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution Emissions Air Quality Measurement		EPA 68A

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
	20. SECURITY CLASS *(This page)*	22. PRICE

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

EPA-450/4-74-006
(OAQPS NO. 1.2-024)

GUIDELINES FOR AIR QUALITY MAINTENANCE PLANNING AND ANALYSIS
VOLUME 5 :
CASE STUDIES IN PLAN DEVELOPMENT

ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

December 1974

OAQPS GUIDELINE SERIES

This report is one of the guideline series of reports issued by the Environmental Protection Agency, Office of Air Quality Planning and Standards (OSOPS), to provide information on air quality maintenance to state and local air pollution control agencies. Copies are available free of charge to Federal employees, current contractors, grantees, and nonprofit organizations, as supplies permit, from the Air Pollution Technical Information Center, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, or at a nominal cost from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

This report was furnished to the Environmental Protection Agency by the Research Triangle Institute, Research Triangle Park, N.C., in fulfillment of Task Order No. 9, Contract No. 68-02-1386. The contents are reproduced herein as received form the contractor. Prior to final preparation the report underwent review and editing by the Environmental Protection Agency. The report constitutes digests of trial Air Quality Maintenance Plans developed by four contractors for Baltimore, Denver, St. Louis, and San Diego. These trial Air Quality Maintenance Plans were developed prior to the issuance of all of the guideline documents and, accordingly, practices and procedures used are not necessarily those now advocated by the Environmental Protection Agency. Schedules published in Federal regulations take precedance over schedules given in the trial plans.

Publication No. EPA-450/4-74-006
(OAQPS Guideline No. 1.2-024)

FOREWORD

Through the publication of *Guidelines for Air Quality Maintenance Planning and Analysis*, the U.S. Environmental Protection Agency provides State and local agencies with information and guidance for the preparation of Air Quality Maintenance Plans required under 40 CFR 51. The volumes in this series are:

Volume 1. *Designation of Air Quality Maintenance Areas*.
Volume 2. *Plan Preparation*.
Volume 3. *Control Strategies*.
Volume 4. *Land Use and Transportation Considerations*.
Volume 5. *Case Studies in Plan Development*.
Volume 6. *Overview of Air Quality Maintenance Area Analysis*.
Volume 7. *Projecting County Emissions*.
Volume 8. *Computer-Assisted Area Source Emissions Gridding Procedure*.
Volume 9. *Evaluating Indirect Sources*.
Volume 10. *Reviewing New Stationary Sources*.
Volume 11. *Air Quality Monitoring and Data Analysis*.
Volume 12. *Applying Atmospheric Simulation Models to Air Quality Maintenance Areas*.
Volume 13. *Allocating Projected Emissions to Sub-County Areas*.
Volume 13. *Appendixes A and B*.
Volume 13. *Supplement: Accounting for New Source Performance Standards in Projecting and Allocating Emissions - Hypothetical Example*.

Additional volumes may be issued.

All references to 40 CFR Part 51 in these documents are to the regulations as amended through July 1974.

TABLE OF CONTENTS

Chapter		Page
	LIST OF FIGURES	vii
	LIST OF TABLES	vii
I	INTRODUCTION	1
II	SAN DIEGO TRIAL AIR QUALITY MAINTENANCE PLAN	5
	I. Characterization of the San Diego Air Quality Maintenance Study Area	5
	II. Intergovernmental Cooperation	6
	III. Baseline Emissions Inventory	14
	IV. Emission Projections	17
	V. Establishment of Baseline Air Quality	18
	VI. Air Quality Projections to 1985	22
	VII. Selection of Maintenance Strategies	23
	VIII. Legal Authority	33
	Summary of San Diego AQMSA	35
III	ST. LOUIS TRIAL AIR QUALITY MAINTENANCE PLAN	41
	I. AQMSA Description	41
	II. Intergovernmental Cooperation	41
	III. Baseline Emissions Inventory	52
	IV. Emission Projections	55
	V. Establishment of Baseline Air Quality	59
	VI. Air Quality Projections	61
	VII. Selection of Maintenance Strategies	67
	VIII. Legal Authority	74
	Summary of St. Louis AQMSA	76
IV	BALTIMORE TRIAL AIR QUALITY MAINTENANCE PLAN	81
	I. Characteristics of Baltimore AQMSA	81
	II. Intergovernmental Cooperation	85
	III. Baseline Emissions Inventory	97
	IV. Emission Projections	99
	V. Establishment of Baseline Air Quality	102
	VI. Air Quality Projections to 1985	103
	VII. Selection of Maintenance Strategies	104
	VIII. Legal Authority	108
	Summary of Baltimore AQMSA	109

TABLE OF CONTENTS (continued)

Chapter | Page
V DENVER TRIAL AIR QUALITY MAINTENANCE PLAN 115

- I. Denver AQMA Characteristics 115
- II. Intergovernmental Cooperation 117
- III. Baseline Emissions Inventory 129
- IV. Emission Projections 132
- V. Establishment of Baseline Air Quality 136
- VI. Air Quality Projections to 1985 138
- VII. Selection of Maintenance Strategies 141
- VIII. Legal Authority 144
- Summary of Denver AQMSA 146

LIST OF FIGURES

Figure — Page

II-1 Alternative "A"--AQMP Process Carried Out by CPO 9
II-2 Alternative "B"--AQMP Process Carried Out By APCD 11
III-1 St. Louis Air Quality Maintenance Study Area 42
III-2 Existing AQMSA Responsibilities 44
III-3 Missouri Air Conservation Commission Advisory Committee on Transportation Control 47
III-4 St. Louis AQMP Development and Coordination 51
III-5 St. Louis AQMP Development Timetable 73
IV-1 Baltimore Air Quality Control Region 82
IV-2 Projected Effectiveness of SIP and AQMP 84
IV-3 Existing Institutional Relationships--Baltimore Air Quality Maintenance Planning 96
IV-4 Sample Matrix Showing Evaluation Data for Control Measures Affecting Domestic and Commercial Heating and Cooling as a Suspended Particulate Source Category 106

LIST OF TABLES

Table — Page

II-1 TECHNICAL ASSUMPTIONS 16
II-2 SAN DIEGO COUNTY AIR QUALITY, 1972 20
II-3 ORGANIZATION OF DELPHI STUDY 30
II-4 REGIONAL COMPREHENSIVE PLAN POLICIES AND TRANSPORTATION PLANNING GUIDES 32
III-1 ST. LOUIS AIR QUALITY MAINTENANCE STUDY AREA EMISSION PROJECTION - SUMMARY 58
III-2 ST. LOUIS AQMSA - SUMMARY OF AIR QUALITY PROJECTIONS 64
III-3 PROPOSED ATTAINMENT/MAINTENANCE PLAN 71
V-1 AQMP PREPARATION INPUT 126

Chapter I

INTRODUCTION

This guideline is the fifth in a series issued by the Environmental Protection Agency (EPA) to assist the states in the preparation of Air Quality Maintenance Plans (AQMPs) required under 40 CFR 51. While this series of documents was in preparation, a concurrent effort was made to provide EPA with experience in the actual preparation of AQMPs by developing trial maintenance plans for Baltimore, Denver, St. Louis, and San Diego. Each of these trial AQMPs was summarized, for inclusion in this guideline document, by the contractor* who prepared the plan.

The contractors selected to prepare trial AQMPs were experienced in the technical phases of air pollution control planning and implementation. This experience was essential since both the contractors and EPA were engaged in developing the techniques for Air Quality Maintenance Area (AQMA) analysis and in exploring new relationships for intergovernmental cooperation.

The trial AQMPs prepared during this study represent exercises to demonstrate administrative and technical procedures available and do not necessarily constitute final, acceptable plans. Because no precedents were available while these trial AQMPs were in preparation, analysis procedures used do not always conform to the procedures subsequently published in the guidelines. The time available and the resources that could be committed to these studies were too limited to permit thorough exploration of all aspects of air quality maintenance planning. Nevertheless, the interpretation of analyses, the intergovernmental relationships, and the maintenance strategies developed for these examples will be useful to, but are not binding on, the officials responsible for developing AQMPs for the areas considered. Whenever dates given in the trial plans are inconsistent with dates in EPA regulations, EPA dates govern.

For each of the four cities selected for trial AQMP preparation, an associated area having the potential for violating the National Ambient

---

*Allen M. Voorhees and Associates, Inc.; Engineering-Sciences, Inc.; GCA Corporation; and TRW, Transportation and Environmental Operations.

Air Quality Standards during the period 1975 to 1985 was identified; for the purposes of the trial plans, these areas were designated as Air Quality Maintenance Study Areas (AQMSAs). These AQMSAs have many of the problems that can be expected to be encountered in the preparation of AQMPs for the AQMAs designated by the Administrator. The digests of AQMPs presented in this volume provide an opportunity for reviewing the highlights of plan preparation experience, including solutions to problems experienced. The full text versions of the four trial AQMPs will be available from the National Technical Information Service (NTIS). The full titles, EPA report number and the NTIS number of the full text trial AQMPs are:

Development of a Trial Air Quality Maintenance Plan Using the Baltimore Air Quality Control Region.	EPA-450/3-74-050 NTIS PB 416/AS
Development of an Example 10-Year Air Quality Maintenance Plan for the Denver AQMSA.	EPA-450/3-74-053 NTIS PB 237-414/AS
Development of a Trial Air Quality Maintenance Plan for the St. Louis AQMSA.	EPA-450/3-74-052 NTIS Not assigned
Development of a Sample Air Quality Maintenance Plan for San Diego.	EPA-450/3-74-051 NTIS PB 236-932/AS

The characteristics of the AQMPs for which trial plans were prepared range from single county to two-state, multi-county political jurisdiction, from three to four criteria pollutants of concern, through existing control agency activity varying over a wide range, from minimum to intense popular concern for environmental quality, and from virtually no assigned responsibility or authority, to well-coordinated interagency cooperative activity.

The four digests of the full text trial AQMPs have been prepared in identical format to facilitate comparison of the problems encountered and solutions proposed. The subjects covered in each of the trial AQMP digests are:

- Characteristics of the AQMSA
- Intergovernmental cooperation
- Baseline emissions inventory

- Emissions projections
- Baseline air quality
- Air quality projections
- Selection of maintenance strategies
- Legal authority

Appended to each trial AQMP digest is a summary for each pollutant of concern giving the baseline year air quality, the anticipated air quality for the year of scheduled attainment, the percentage reduction required to reduce baseline year air quality to NAAQS, and the control strategies and date of implementation required to attain NAAQS.

Throughout the preparation of these trial AQMPs, invaluable assistance was provided by State, regional, and local air pollution control officials, staff members of planning agencies, highway or transportation departments and councils of government, and EPA regional representatives. Full acknowledgement of this cooperation is made in the several individual full text trial AQMPs.

The preparation of these digests of the four trial AQMPs has been under the direction of Mr. Thomas M. Donaldson, EPA Project Officer, assisted by other members of the staff of the Plans and Guidelines Section, Standards and Implementation Branch, Control Programs Development Division of the Office of Air Quality Planning and Standards.

Chapter II

SAN DIEGO TRIAL AIR QUALITY MAINTENANCE PLAN

I. Characterization of the San Diego Air Quality Maintenance Study Area

The San Diego Intrastate AQCR, also known as the San Diego Air Basin, is located in the southwest corner of the State of California and consists of the western two-thirds of San Diego County. It is bounded on the east by the summit of the peninsular range, on the north by Orange County, on the south and west by Mexico and the Pacific Ocean, respectively. The airshed has a land area of approximately 3040 square miles and, as of 1970, a population of some 1.36 million people and 790,000 motor vehicles. The population is concentrated primarily in the City of San Diego and the incorporated areas along the coast.

Analysis of air quality and air quality trends indicates that the San Diego Intrastate AQCR will have attainment/maintenance problems with regard to meeting National Ambient Air Quality Standards (NAAQS) with regard to CO, particulate matter (TSP), and photochemical oxidants (O_x) during the period 1975-1985. Peak measurements of 0.32 ppm for oxidant (hourly average), 19 ppm for CO (8-hour average), and 97 $\mu g/m^3$ for particulates (annual geometric mean) in 1972 indicate that emission reductions of 75% for reactive hydrocarbons, 53% for carbon monoxide, and 55% for particulate matter will be required in order to meet the national standards for air quality. Oxides of nitrogen and sulfur dioxide are not a problem at present, nor are they projected to become a problem through 1985.

Air pollution control in the region is primarily the responsibility of the San Diego County APCD. Since the airshed is contained within one county, no additional regional coordinating council is required for emissions control, as in some of the other multi-county airsheds within the state.

Overall, the data bases in San Diego are quite good. More often than not, the problem is not the lack of available data but attempting to reconcile the differences between several different data sets. Frequently, this problem is as sensitive to the political environment as it is to technical judgements.

Preceding page blank

II. Intergovernmental Cooperation

The agencies that would be involved in the development and implementation of an air quality maintenance plan are listed below:

- State of California Air Resources Board(ARB)
- San Diego County Air Pollution Control District (APCD)
- Comprehensive Planning Organization of the San Diego Region (CPO)
- Local Planning Agencies
  - County Office of Environmental Management
  - City of San Diego Dept. of Environmental Quality
  - City of San Diego Planning Commission
  - City of Carlsbad Planning Commission
  - City of Chula Vista Planning Commission
  - City of Coronado Planning Commission .
  - City of Del Mar Planning Commission
  - City of El Cajon Planning Commission
  - City of Escondido Planning Commission
  - City of Imperial Beach Planning Commission
  - City of La Mesa Planning Commission
  - City of Vista Planning Commission
  - City of National City Planning Commission
  - City of Oceanside Planning Commission
  - City of San Marcos Planning Commission
  - City of Vista Planning Commission
- Regional Special Purpose Agencies:
  - San Diego Port Authority
  - Regional Water Quality Control Board
  - Regional Coastline Development Commission
  - California Department of Transportation (CalTrans)

Air Pollution control responsibility is divided between the State ARB and the County APCD. The APCD has permit review authority for stationary sources of air pollution, while the State ARB has taken on the responsibility for mobile source control.

Land-use and transportation planning activities are centered in the CPO, which includes housing and open space elements. CPO has the A-95 review authority for federal grants, is the HUD 701 planning agency, and also is the 3C transportation planning agency under Section 109 (J) of the Federal Highway Act of 1972. The CPO's Transportation Board must prepare its transportation plans such that they are consistent with the State air quality implementation plan. This requirement was not appropriately addressed in initial transportation plans that were rejected by the ARB.

CalTrans has subsequently made a substantial commitment to include air quality considerations in future planning efforts. Water quality planning is the function of the Regional Water Quality Control Board, while conventional zoning, subdivision regulations, building code and housing code variances are administered by the local planning commissions for each of the incorporated cities and the county.

The approach to be taken in developing and implementing air quality maintenance procedures into San Diego's land-use decision-making process must meet two constraints mandated by the Clean Air Act. First, the approach should provide for a comprehensive review of any future growth and development significantly affecting AQMSA air quality. Second, the State of California Air Resources Board is charged with the responsibility for complying with the Clean Air Act, although the ARB can delegate some of this responsibility to local APCDs if it so chooses. In cases where the state has failed to take appropriate action, the Clean Air Act requires that the federal government must intervene.

Except in cases where a region's resources are shared by and vital to the public sector of a larger community, it would be presumption for either the state or the federal government to attempt to externally impose land-use controls on a given AQMSA. "Outsiders" cannot be expected to make the trade-offs necessary to the formulation of an AQMP tailored to the unique needs and goals of the populace within a specific region. Thus, it is appropriate that regional and local agencies assume the responsibility for development and implementation of the air quality maintenance plan for San Diego. In order to deal effectively with a regional problem like air pollution, such an agency must have a regional perspective on the problem and the expertise necessary to deal with it.

Unfortunately in San Diego, no single agency has the expertise required for both the air pollution control and land use planning functions. These skills reside with the Comprehensive Planning Organization (CPO) and the County Air Pollution Control District (APCD). Thus, two basic alternatives are identified as possible institutional arrangements for incorporating air quality management into the San Diego land-use decision-making process. It should be noted that regardless of which institutional arrangement is eventually selected, the lead agency must rely heavily on the other agencies in the region in order for the maintenance plan to be truly effective.

A. Alternative "A"--AQMP Process Carried Out by CPO

This alternative would require the ARB to recognize CPO as the lead local agency in charge of developing an AQMP. The AQMP would become part of the regional comprehensive plan. The APCD would lend technical assistance in plan development; however, CPO would assume the stronger position in developing the AQMP through their role in land use and transportation planning on matters of a regional significance (see figure II-1).

Alternative "A" should provide some regulatory power to CPO for enforcing elements of the general plan pertaining to regional air quality so that their plan is no longer viewed as being purely advisory. The intent would be to develop a combined land use/transportation plan that contains the balance necessary for minimizing VMT while also presenting a more unified and consolidated approach for state, regional and local government coordination. Most land use decisions would continue to be made by the local, general purpose governments; however, CPO should be in a position to exercise limited veto authority and to review all transportation projects and new developments of regional significance by being vested with review of indirect sources, parking management and parking facility planning, in addition to its A-95 review power.

Representatives from federal military installations in the San Diego region and the Environmental Protection Agency might assume a regular ex-officio role on the CPO board so that their respective activities could be made known further in advance.

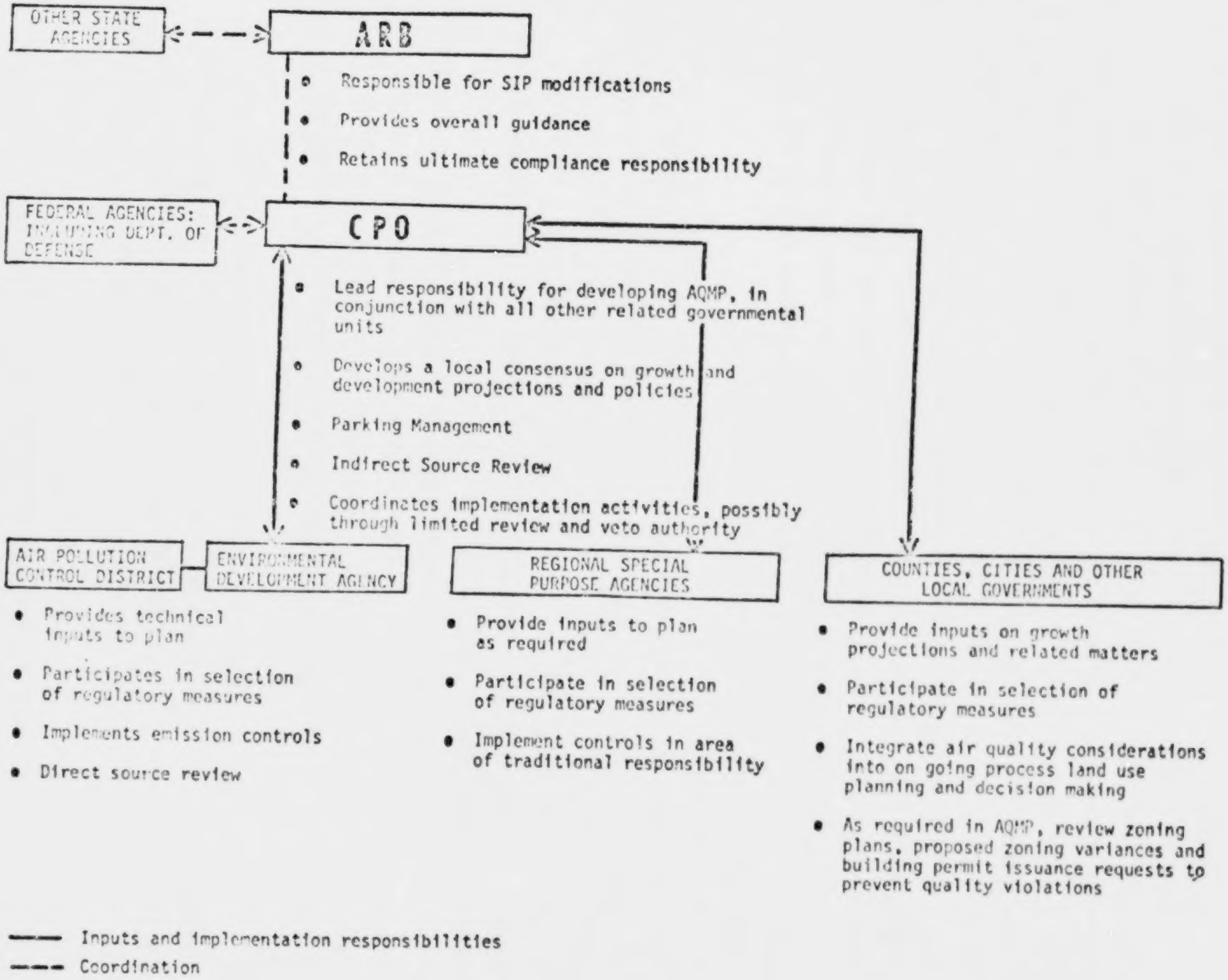

OTHER STATE AGENCIES
ARB
Responsible for SIP modifications
Provides overall guidance
Retains ultimate compliance responsibility
FEDERAL AGENCIES: INCLUDING DEPT. OF DEFENSE
CPO
Lead responsibility for developing AQMP, in conjunction with all other related governmental units
Develops a local consensus on growth and development projections and policies
Parking Management
Indirect Source Review
Coordinates implementation activities, possibly through limited review and veto authority
AIR POLLUTION CONTROL DISTRICT
ENVIRONMENTAL DEVELOPMENT AGENCY
Provides technical inputs to plan
Participates in selection of regulatory measures
Implements emission controls
Direct source review
REGIONAL SPECIAL PURPOSE AGENCIES
Provide inputs to plan as required
Participate in selection of regulatory measures
Implement controls in area of traditional responsibility
COUNTIES, CITIES AND OTHER LOCAL GOVERNMENTS
Provide inputs on growth projections and related matters
Participate in selection of regulatory measures
Integrate air quality considerations into on going process land use planning and decision making
As required in AQMP, review zoning plans, proposed zoning variances and building permit issuance requests to prevent quality violations
Inputs and implementation responsibilities
Coordination

Figure II-1. Alternative "A"--AQMP Process Carried Out by CPO

B Alternative "B"--AQMP Process Carried Out by the APCD

Under this alternative the County APCD would be responsible for preparation of and insuring local compliance with the San Diego AQMP. Since the CPO Board of Directors consists essentially of representatives from each of the incorporated cities within the county as well as the county itself, it seems appropriate that CPO should fulfill the role of coordinator of the planning of the land-use control element of the AQMP. Thus, under this institutional arrangement the APCD avoids entering directly into the land use planning arena while still retaining the local responsibility for compliance with the mandate of the Clean Air Act (see figure II-2). CPO retains its role of planning coordinator as well as its other responsibilities with regard to parking management plans and A-95 review.

C. Discussion

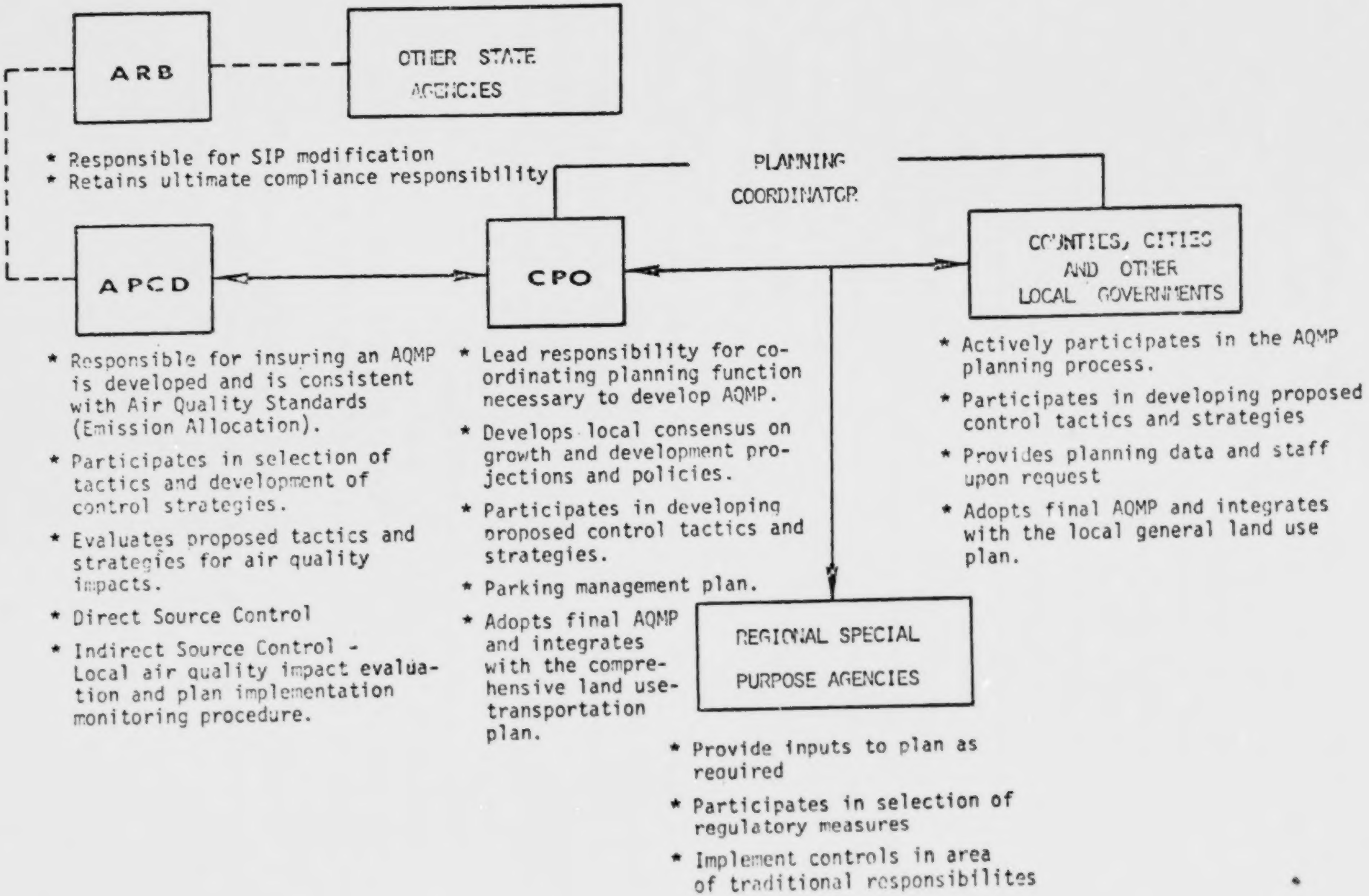
The essential difference between the two organization schemes presented lies in the delegation of the indirect source review responsibility. Clearly, the agency that has this responsibility holds the key to enforcement of a long-term air quality maintenance plan. On that basis, the same agency should also logically have the lead responsibility for the preparation of the AQMP.

In order for Alternative A to become a reality, CPO must be granted the power of indirect source review, either by its member governments through a joint exercise of power agreement, or by EPA or the State Air Resources Board under the authority and responsibility mandated in the Clean Air Act.*

Alternative B currently suffers from uncertainties in the legal interpretation of the nature of indirect sources. The Attorney General of the State of California has written an opinion that states that local air pollution control districts currently have the authority to implement

---

*40 CFR 52.22 (b) and Appendix A, thereto.


ARB
OTHER STATE AGENCIES
PLANNING COORDINATOR
APCD
CPO
COUNTIES, CITIES AND OTHER LOCAL GOVERNMENTS
REGIONAL SPECIAL PURPOSE AGENCIES

ARB:

- Responsible for SIP modification
- Retains ultimate compliance responsibility

APCD:

- Responsible for insuring an AQMP is developed and is consistent with Air Quality Standards (Emission Allocation).
- Participates in selection of tactics and development of control strategies.
- Evaluates proposed tactics and strategies for air quality impacts.
- Direct Source Control
- Indirect Source Control - Local air quality impact evaluation and plan implementation monitoring procedure.

CPO:

- Lead responsibility for coordinating planning function necessary to develop AQMP.
- Develops local consensus on growth and development projections and policies.
- Participates in developing proposed control tactics and strategies.
- Parking management plan.
- Adopts final AQMP and integrates with the comprehensive land use-transportation plan.

Counties, Cities and Other Local Governments:

- Actively participates in the AQMP planning process.
- Participates in developing proposed control tactics and strategies
- Provides planning data and staff upon request
- Adopts final AQMP and integrates with the local general land use plan.

Regional Special Purpose Agencies:

- Provide inputs to plan as required
- Participates in selection of regulatory measures
- Implement controls in area of traditional responsibilites

Figure II-2. Alternative B - AQMP Process Carried Out By APCD

indirect source review. Conversely, a recent court decision (State Court of Appeals, Western Oil and Gas Association vs. Orange County Air Pollution Control District) reaffirmed the jurisdiction of the State Air Resources Board over motor vehicle emission control and in so doing raised the question of whether indirect source review should be considered stationary or mobile source control.

The uncertainty appears to center on the interpretation of the nature of the powers of the APCDs. If it is interpreted that the APCDs have only those power specifically designated in the State Health and Safety Code, then serious questions are raised as to the validity of the Attorney General's opinion. Conversely, if it is interpreted that the APCDs have authority over all realms of air pollution control except those specifically pre-empted by higher authority, then it is likely that the Attorney General's opinion would hold. The court ruled that the APCD could not regulate the fuel composition for automobiles since this constituted a control over automobile emissions that should properly be the jurisdiction of the State Air Resources Board. The problem is that this decision may be considered to apply to indirect source review by analogy. It is conceivable that indirect source review may be considered regulation of automobile emissions, since it is precisely auto emissions that such review procedures are designed to minimize. The situation is further complicated by the fact that indirect source review may also be considered a form of land-use control--an area that has always been the domain of local government.

If it is resolved that the APCDs do not currently have authority to implement indirect source review, responsibility for the delegation of that authority would revert back to the State Air Resources Board or, if the ARB does not act, to EPA, under the mandate of the Clean Air Act.

On the other hand, it seems proper that indirect sources should be classified as stationary sources and the Attorney General's office has asked for a clarification of the ruling with regard to this point.

Assuming that the court rules in favor of APCDs on this point, there remains but one potential drawback to Alternative B. The problem is that the County Board of Supervisors must fulfill a dual role--one role as administrators of the unincorporated areas of the county, and another as reviewers of the activities of the Air Pollution Control District, which has county-wide jurisdiction. Such a dual role could potentially lead to a conflict of interest on such development projects as the construction of county roads. This is not an insurmountable problem, although it is one that must be recognized and dealt with openly. It is not likely that the Board of Supervisors would attempt to usurp the authority of either the Air Pollution Control Officer or the Air Pollution Control Board. However, if such an unwritten relationship is unacceptable, the State Air Resources Board could serve as official review agency for county-sponsored indirect sources in order to prevent potential conflicts of interest.

A third option exists apart from the two alternatives just described. Under this option CPO and the APCD would share the indirect source review authority through the formation of a joint governing body. This option is attractive from the standpoint that it ensures a high degree of participation on the part of both CPO and APCD to ensure that there was a responsible entity for each portion of the plan preparation and of the plan enforcement.

D. Problems

- The present government structure for land-use decision-making is fragmented, and not oriented toward addressing regional problems such as air pollution.

An important prerequisite to the development of an air quality maintenance plan is the construction of an appropriate scheme for integrating the multiple jurisdictions for air pollution, transportation, and land-use decision-making. In areas where mobile source pollution problems predominate, the designation of indirect source review authority is the key decision that must be made.

III. Baseline Emissions Inventory

A. Baseyear Selection

The baseline year for all pollutants was 1972 since the latest complete inventory could be obtained for that year, and because the latest complete air quality data were for that year. In addition the air quality data for 1972 were comparable to the data obtained for the four previous years.

B. Emission Data Sources

There were two emission data sources in San Diego: the Air Pollution Control District provided data concerning both point and area source emissions for all pollutants, while the local office of the California Department of Transportation provided data concerning present and projected vehicle miles traveled (VMT).

C. Geographic Location of Sources

The coordinate system utilized in San Diego was the California State Plan coordinate system. This system was used instead of the UTM (Universal Transverse Mercator) system because the software used for the emissions gridding procedure was based on the use of a State-Plane grid. The NEDS data coded for input to this software package were coded in both UTM and State Plane coordinates in order to satisfy EPA requirements, and the input requirements of the software.

D. Technical Assumptions

The bulk of the technical assumptions used in determining emission factors, emission source control efficiency, and the reactive fraction of total hydrocarbon emissions was obtained from a meeting between EPA, State Air Resources Board, and local agency representatives. The specific purpose of the meeting was to develop a single set of assumptions to be used in subsequent transportation control planning efforts. Assumptions used are summarized in Table II-1. Where agreement could not be reached, EPA-sanctioned assumptions were used. In addition a 90% reduction in reactive hydrocarbon emissions from gasoline marketing operations as prescribed by recent County APCD regulations was assumed.

E. Problems

- There remains a controversy concerning the most proper set of emission factors, and the fraction of those emissions that should be considered reactive for several source categories including autos, aircraft, diesels, and wild fires.

In San Diego, the meeting between representatives of EPA, the State Air Resources Board, the APCD, and other local agencies was quite valuable and necessary to the successful implementation of a meaningful control program. Ultimately, it is the effective implementation of the control measure that determines the success of a control program, rather than bickering over the proper set of technical assumptions to be used for planning purposes. Such effective implementation can only come through cooperative attitudes on the part of everyone involved. The technical assumptions meeting was a big step toward this ultimate goal.

- The discovery of previously neglected sources can drastically alter control requirements for both attainment and maintenance.

In San Diego, reactive hydrocarbon emissions due to wild fires and certain uncontrolled engines (lawnmowers, chain saws, dunebuggies, competition vehicles, etc.) were not accounted for in the promulgated transportation control plan. A recent study by Automotive Environmental Systems, Inc. for the State ARB was used to estimate both baseline and projected emissions. Since these sources are expected to remain uncontrolled, the resulting effect is to increase control requirements for other components of the emission inventory. Further, by 1985, the full impact of the federal motor vehicle control program for new automobiles will be felt. Therefore any further reductions in emissions must come from either VMT reductions or from other source categories such as heavy duty vehicles, motorcycles, and aircraft.

Table II-1. TECHNICAL ASSUMPTIONS

EMISSION SOURCE	ASSUMPTION	BASIS
Organic Solvents		
Metal Surface Coating	100% Reduction in emissions	Substitution of NO_x reactive solvents
Dry Cleaning	90% Reduction in emissions	Use of adsorption systems
Degreasing	100% Reduction in emissions	Substitution of NO_x reactive solvents
Petroleum Marketing	93% reactive; 90% reduction in emissions	APCD regulations effective in 1974
Fuel Combustion	100% reactive; EPA emission factors	
Diesel-Stationary	99% reactive; EPA emission factors	
Wild Fires	100% reactive	
Aircraft	90% reactive; 30% reduction in emissions for 1977 and later	EPA regulations
Light Duty Motor Vehicles		
Emission Factors	RAND Corp. emission factors used in lieu of EPA factors	RAND emission factors higher; degradation factors lower
Control Measure Effectiveness	Inspection/maintenance: 15% reduction in RHC[a] emissions 12% reduction in CO emissions	
	Retrofit (1955-65 models): 25% reduction in RHC emissions 28% reduction in CO emissions	
	Retrofit (1966-70 models): 14% reduction in RHC emissions 10% reduction in CO emissions	
	Oxidizing Catalyst Retrofit: 70% reduction in RHC emissions 60% reduction in CO emissions	
Speed Corrections	EPA factors used.	

---

[a] RHC = reactive hydrocarbons

IV. Emission Projections

A. General Methodology

Emissions for all pollutants were projected according to projected changes in either employment or population. Industrial emissions were projected from the baseyear inventory by assuming that changes in emissions were proportional to changes in employment. Employment projections for 22 broad industrial categories (essentially corresponding to a two-digit SIC code level of disaggregation) made by the Comprehensive Planning Organization to the year 1995, with an intermediate projection to 1985 were used.* In the special case of power plant emissions, projections of emissions from power plants in the AQMA were obtained indirectly from the local electric power utility, San Diego Gas and Electric Company. (The APCD obtained the information and forwarded it to us after we made an unsuccessful attempt to obtain the data ourselves.) Residential and commercial fuel combustion emissions were projected on the basis of CPO population projections, since natural gas demand in these categories is expected to be satisfied by SDG&E, with no switch to fuel oil or other fuel anticipated.

Although air quality considerations were not adequately addressed in the regional transportation plan as required under Section 109 (J) of the Federal Highway Act of 1972, the VMT projected under this plan (which is integrated with the regional comprehensive plan) was utilized for the purpose of projecting motor vehicle emissions for the San Diego region. The APCD had attempted to estimate motor vehicle VMT on the basis of registration data for various vehicle types and assumptions concerning average annual mileage per vehicle. The percentage split of the total VMT between the various vehicle types under this methodology was combined with the total VMT projections of CPO to provide estimates of light and heavy duty vehicle VMT as well as diesel and motorcycle VMT. These VMT estimates were then combined with the appropriate emission factors to obtain emission estimates. In the case of LDV emissions, emission and deterioration factors developed by the RAND Corporation in a previous study of the San Diego air quality problem were used. EPA emission and deterioration factors were used for heavy duty vehicles, diesels, and motorcycles.

---

*The federal OBERS projections for industrial activity in standard metropolitan statistical areas were rejected since they were based on outdated population projections.

B. Problems

- Conflicting projections of population and economic activity were available for the San Diego area.

The local COG in San Diego (The Comprehensive Planning Organization) had obviously devoted much more time and effort to their projections of population and employment than had either the state or the federal government agencies. The fact that their projection matched well with the projection performed by the State Department of Finance reinforced the conclusion that the local projections were the most appropriate set. The Series C projections of the U.S. Department of Commerce, which form the basis of the OBERS projections, were found to diverge significantly from both the state and local projections.

- Air Quality Maintenance Planning requires long term emission projections that are not commonly made in most emission producing industries.

The approach taken in San Diego of keying the emission projection for industrial categories to employment projections for the same categories is admittedly crude, yet when dealing with such long term projections it is questionable that increased sophistication will yield more definitive results.

V. Establishment of Baseline Air Quality

A. Baseyear Selection

The baseyear for air quality was 1972, as mentioned previously. This was due to the fact that 1973 was considered an unusual year meteorologically, while air quality in 1972 was at least as bad as any of the previous years in the cases of oxidant and carbon monoxide and worse than any previous year in the case of particulate matter. Air quality for 1972 is summarized in Table II-2.

B. Time Compatibility of Baseline Air Quality and Emissions

The baseline air qualtiy and emissions data were for the same period. Had there been a conflict in the data bases, the most appropriate course of action would have been to adjust the emission inventory either forward, following the projection methodology outlined, or backward according to historical trends.

C. Sources of Air Quality Data

Three sources of air quality data were consulted: the EPA SAROAD data bank of NASN (National Air Sampling Network) station data (one station in San Diego), the State Air Resources Board quarterly air quality summaries, and the Air Pollution Control District air quality data file.

D. Accuracy and Representativeness of data

In the case of oxidants, six stations in the San Diego region reported oxidant concentrations. Since oxidant is a regional scale pollutant, the fact that data from all of the stations indicated that comparable levels of oxidant were being experienced from time to time at all locations indicated that the monitoring network was probably adequate for this pollutant. In the case of carbon monoxide and particulate matter, only two stations in the region were equipped to monitor these pollutants. In both cases it is recommended that additional monitoring stations be deployed, however, since both pollutants are generated such that large variations (local hot spots) may occur, it is debatable whether any network could be devised that would be judged adequate (e.g., one properly should have CO monitors at every busy intersection to adequately monitor for potential violations of CO air quality standards). In addition, in the case of particulate matter, the particulate samples

Table II-2. SAN DIEGO COUNTY AIR QUALITY, 1972

Pollutant	Current Level	Applicable Standard	% Rollback Required
Oxidant	0.32 ppm (1-hour maximum)	.08 ppm	75%
Carbon Monoxide	19 ppm (8-hour average)	9 ppm	53%
Suspended Particulate Matter	97 $\mu g/m^3$ (annual geometric mean)	60 $\mu g/m^3$	55% *
Nitrogen Dioxide	.04 ppm (annual average)	.05 ppm	0
Sulfur Dioxide	.005 ppm (annual average)	.03 ppm	0

---

*Assumes an uncontrollable background of 30 $\mu g/m^3$. Emissions of particulate matter must be rolled back to the secondard standard due to the fact that the originally approved state implementation plan indicated that the secondard standard for particulate matter would be met in San Diego.

should be subjected to chemical analysis in order to identify the sources and hence air in the specification of the appropriate control strategy.

E. Estimation of Air Quality from Monitoring Data

For particulate matter and carbon monoxide, the peak concentrations measured were taken to indicate air quality with regard to those pollutants. In the case of oxidant, a Larsen analysis* of the air quality data was facilitated by the availability of cumulative frequency summaries of the hourly data. In addition, since there had been much controversy in previous studies of the San Diego air pollution problem concerning the validity of the peak concentrations used, it was felt that a Larsen analysis to determine statistically the expected maximum concentration would serve to establish the baseline air quality on a firmer footing.

F. Problems

- Monitoring data for particulate matter were sufficient for indicating that a problem existed, but insufficient to define the extent of the problem and the relative contribution of each source type to the high concentrations measured.

Two recommendations were made in San Diego: first, to increase the number of "hi-vol" sampling stations, and second to begin performing chemical analyses of the particulate samples collected. In the meantime, plume computations under worst case assumptions were utilized to identify potential source contributions to the high levels measured. The point source emission inventory of particulate matter emissions was displayed on a grid. A cursory examination of the gridded inventory indicated that the most likely contributor to high particulate measurements in El Cajon was the rather extensive mineral extraction activity in the Mission Valley area, generally upwind from the El Cajon monitoring site. A simple Gaussian plane model was applied, assuming that the plume centerline passed directly over the El Cajon site at an annual average windspeed of 2 m/sec and "D" class stability. The resulting computed concentration was compared with a similar computation for line source emissions from a nearby freeway, also generally upwind from the El Cajon site, although much closer than any significant point source emissions.

---

*Larsen, R.I. A Mathematical Model for Relating Air Quality Measurements to Air Quality Standards. U.S. EPA AP-89. November 1971.

These computations indicated that motor vehicles are most likely the major source of particulates of the El Cajon sites. Thus, a likely candidate for control was identified, while still reserving final judgment until more definitive data could be obtained. Motor vehicles were suspected of contributing significantly to particle concentrations at El Cajon because of the proximity of the freeway and relatively high concentrations of lead in the collected particles.

VI. Air Quality Projections to 1985

A. General Methodology

Projections of oxidant and carbon monoxide air quality were handled through proportional relationships to emissions. More sophisticated modeling techniques were rejected from consideration due to the complexity of the San Diego meteorology and topography.

Since particulate matter is a potentially localized problem, a proportional rollback of regional emissions of particulate matter was not advocated. Instead, simple Gaussian plume computations were made to identify the most likely sources of the high particulate loadings, with the recommendation that chemical analysis of the particulate samples be used to confirm or deny the results of the plume computations.

B. Problems

- A fundamental weakness of emission allocation procedures is the inadequate state-of-the-art for relating a given emission pattern to the resulting air quality.

The state-of-the-art of oxidant modeling is sophisticated on the scale of smog chamber experiments, yet is inadequate for atmospheric work since detailed data on the reactants, their relative concentrations and the reaction time constraints are not available. The situation is not much better in the case of particulate matter due to the complicated topography and land/sea breeze circulation pattern in San Diego.

The ultimate goal of emission allocation procedures is to help to channel growth and development into areas in which increased emissions will impact the regional air pollution picture the least. Thus, this goal is frustrated by the modeling for addressing this problem in complicated meteorological domains.

VII. Selection of Maintenance Strategies

An air quality maintenance plan may be visualized to consist of a technological control element and a land use and transportation control element. As a region grows in population, per capita consumption, and hence emissions, technological controls must become increasingly stringent in order for the region to accommodate the growth and yet maintain air quality. The converse may also be considered to hold--if technological controls cannot alone serve to maintain air quality, land use controls must bear an increasing portion of the burden as growth progresses. Thus we see that a very delicate balance must be maintained between the two control elements and that this balance will become increasingly difficult to maintain as time passes.

Prior to developing potential maintenance strategies for consideration, five previously completed studies of the air pollution problems of the San Diego area were examined. Each of these was concerned with the photochemical oxidant problem. These studies are:

- Rand Corporation study of attainment strategies for photochemical oxidants
- California Air Resources Board Implementation Plan for the San Diego Air Quality Control Region
- EPA technical support document for the attainment of the oxidant air quality standard by 1977
- California Air Resources Board study for the designation of air quality maintenance areas within the state
- Local task force study of attainment strategies for San Diego

None of these studies included in their inventories emissions from uncontrolled engines (except motorcycles in the Rand and EPA studies). Failure to include sources over which no control is anticipated increases the burden of control placed on the remaining sources.

The Rand study, using a 1970 base year, proposed a strategy believed to provide for attainment of hydrocarbon (oxidant) and carbon monoxide standards by 1975 and maintenance of standards through 1995. The strategy proposed comprised strict control of organic solvents; motor vehicle inspection/maintenance program; retrofit of all 1955-74 light duty motor vehicles with catalytic exhaust systems; stringent modification of aircraft ground operations procedures; retrofit of all 1955-1969 light duty motor vehicles with additional evaporation controls; and a VMT reduction through a mileage surcharge.

The State of California ARB study for the implementation plan also was based on a 1970 emissions inventory and proposed measures including 95% reduction of aircraft and ship emissions; retrofit of 1966-74 light duty and 1962-74 heavy duty vehicles with catalytic exhaust systems; inspection/maintenance program for light duty vehicles; gasoline marketing controls; and reduction of vehicle miles travelled.

The plan promulgated by EPA for the attainment of oxidant standards by 1977 included control of substitution of reactive solvents; control of gasoline evaporative emissions in marketing operations; inspection/maintenance of light duty vehicles; retrofit of 1966-70 light duty vehicles with the California vacuum spark advance disconnect; anticipated federal aircraft and motorcycle emission controls; and 11% reduction in light duty vehicle miles travelled; and other reductions in vehicle miles travelled, as necessary. This last measure indicates awareness of the uncertainty of attaining oxidant standards through the more definitive measures proposed.

The Local Agency Task Force Plan was proposed by an ad hoc committee as an alternative to the EPA transportation control plan. The study by this committee called for a 10% reduction in vehicle miles travelled to be accomplished by improving the road system; improving bus service; instituting a 4-day work week; and discouraging auto use through a combination of tax incentives and disincentives. The study assumed federal control of aircraft and ships.

In their study for the designation of maintenance areas, the California ARB proposed no measures for control of emissions. There appears to be some inconsistency in their selection of projection factors for various categories of emission sources; the emissions projected for future years are considerably higher than those used for this trial plan.

It was felt, from the inception of this study, that the selection of land use control measures was best accomplished by local planners and decision makers. Furthermore, it was felt that any measures selected for purposes of an AQMP could only be implemented if they had the support and endorsement of local institutions and governmental agencies. This section presents a discussion of local inputs concerning which land use control measures appear attractive and effective for use in the San Diego region. It is clearly recognized that the reduction of air pollutant emissions can be accomplished by means other than land use and transportation control measures. Crucial elements of the AQMP, for example, are maintaining vigorous controls on stationary point sources and successfully implementing and enforcing an aggressive transportation control plan to reduce vehicular emissions. Implicitly, the assumption of presently available technological controls has been made. Although this assumption has been made, it is certainly felt to be unrealistic and an optimistic estimate of control measure effectiveness. The rationale for such an assumption is more from satisfying the legal requirements of developing a demonstrably effective AQMP than from any technical considerations. From a technical perspective, it is difficult to foresee remaining static in the availability of additional hardware, process modification, product changes, etc., that will reduce industrial emissions, especially given more stringent control requirements. Indeed, if past experience in pollution control is any indicator, it may be that the tighter emission limits will provide the necessary impetus to advance the state-of-the-art control techniques.

The Delphi Panel

There are a number of ways to solicit local inputs into a planning process. Traditionally, the most frequently used mechanisms are to conduct surveys of one kind or another, hold seminars, symposia, and conferences, or to conduct public hearings. Depending on the planning objectives, various combinations of the above procedures are also used. As mentioned, it was decided local inputs--city, county, regional, and state--were essential to the selection of any land use control measures to be incorporated into the AQMP. The vehicle used in this study to solicit such inputs was the Delphi technique--a structured and controlled questionnaire with feedback.

A good description of Delphi is given by Dalkey:[*]

> "In general, the Delphi procedures have three features: 1) anonymity, 2) controlled feedback, and 3) statistical group response. Anonymity effected by the use of questionnaires ... is a way of reducing the effect of dominant individuals. Controlled feedback--conducting the exercise in a sequency of rounds between which a summary of the results of the previous round is communicated to the participants--is a device for reducing noise. Use of statistical definition of the group response is a way of reducing group pressure for conformity; at the end of the exercise there may still be a significant spread of individual opinions. Probably more important, the statistical group response is a device to assure that the opinion of every member of the group is represented in the final response."

In addition to and preceding the Delphi questionnaire, a series of interviews was conducted locally and over the telephone to gather both base data and agency attitudes concerning land use control alternatives for air pollution control. In part, these interviews set the stage for conducting the Delphi questionnaire.

There were several reasons for selecting this procedure for gauging local attitudes towards development of an AQMP. It became quite apparent that air quality was a critical issue in San Diego and that most agencies (as well as individuals) were strongly opinionated concerning the ultimate solution to the problem. In this sense, then, achieving and maintaining clean air was a controversial issue locally. Because of this, it was felt desirable to avoid any direct agency confrontations. On the other hand, it was also felt broad representation from all sectors of the community was needed to add credibility to the planning process. Explicit attempts were made to insure representation from the public and private sectors, city, county, regional, and state agencies, business community and citizens' groups. As a means of accomplishing both objectives as well as incorporating local inputs within the time frame allowed by the study, a one-day (afternoon session) Delphi questionnaire session was planned.

---

[*] Dalkey, N.C., "The Delphi Method: An Experimental Study for Group Opinion," The RAND Corporation, RM-5888-PR, April 1969.

It should be emphasized that the results of the questionnaire are intended only to serve as an indicator of local thinking on potential control measures to be implemented. While the overall administration of the questionnaire was accomplished with no major difficulties, a number of points need to be raised concerning the limitations involved in interpreting the results. While every attempt was made to seek "balanced" representation within the group, it is virtually impossible to avoid individual complaints that the group was "stacked" with planners or governmental officials or some other group. Specifically, during the San Diego session, a number of incidents occurred that may have influenced the final results.

- As expected, not all of the individuals who had agreed to attend did in fact participate. Consequently, the "balance" originally sought never materialized.
- A number of "experts" scheduled to participate sent representatives in their stead. Since this Delphi was structured to solicit "expert" opinion, it is difficult to gauge whether or not the level of expertise originally solicited was as good, better, or worse than the final group of participants.
- Concurrent to the Delphi, two other important meetings were being conducted in San Diego[*], which accounted for a portion of the absenteeism cited above. Since these meetings were scheduled after our meeting had been set up, it was essentially impossible to reschedule. Of significance was the fact that a number of respondents who started the Delphi session were unable to complete it due to other commitments. Thus, the mixture of the group as a whole experienced some change during the afternoon.

---

[*] The other meetings taking place concurrently were a County Board of Supervisors meeting to discuss indirect source review requirements of EPA, and a CPO monthly board meeting.

Despite the above mentioned nuances, sufficient consensus was reached by the group on a number of issues that it was generally felt the exercise was very useful. The group initially assembled numbered twenty, with fourteen representatives completing the full seven rounds of interrogation.

Organizationally, the structure of the survey was aimed at addressing three issues with regard to land use control measures:

- Overall attractiveness--From a shopping list of measures, the participants were asked to select the measures viewed to be "most attractive" in terms of implementability, effectiveness, minimum adverse socioeconomic impacts and public acceptance. This phase of the exercise was completed first, since it was felt regardless of how effective a particular measure might be, if it was not implementable and acceptable, it would never receive serious planning consideration.
- Implementation obstacles--Once it was determined which control measures were viewed as the most attractive, an assessment of the most critical implementation obstacles was solicited. The respondents were asked to consider the relative importance of six potential implementation obstacles--lack of funding, existing governmental structure, lack of enabling legislation, inadequate state-of-the-art technology, public acceptance, and a lack of precedences or a hesitance to be innovative.
- Effectiveness--A number of specific and general objectives were cited and the respondents were asked to assess (by rank ordering) the relative effectiveness of the control measures for achieving the various objectives. Since the objectives dealt with the need for auto travel and growth and development issues, inferences can be drawn regarding the air quality implications of these measures.

Table II-3 presents a summary of the chronological sequencing of issues addressed by the questionnaire. In addition to the actual survey form, a supplemental set of miscellaneous "fact sheets" was provided to each participant. This handout contained descriptive information on what each of the control measures was and a summary of the air pollution situation, i.e., recent emission inventory and air quality data. The intent of the handout was merely to provide backup information to the respondents to assist them in their decisions.

The measures put before the Delphi Panel for consideration are listed below:

Environmental Impact Statement as required by California Environment
    Quality Act (CEQA)
Recreation Land Regulation*
Taxation Policy to Preserve Non-Developed Areas*

SB 1543 (or Similar Regional Development Plans)*
A-95 Review Process
Direct Source Review
Emission Density Zoning*
Open Space Planning
Regional Water Quality Control Board (Permit Review)
"3-C" Review Process
San Diego Coast Regional Commission (General Plan)

Capital Facility Ordinances
General Plan
Zoning Ordinances (Existing)
Planned Unit Development Ordinance
Capital Improvements Programming
Indirect Source Review*
Protection of Critical Environmental Areas
Development Timing Controls*

The set of measures selected by the panel as the most attractive are as follows:

Environmental Impact Statement (CEQA)
Capital Facility Ordinances
Direct Source Review
General Plan
Taxation Policy to Preserve Non-Developed Areas*
SB 1543 (or Similar Regional Development Plans)*
Capital Improvements Programming
Indirect Source Review*
Development Timing Controls

---

*Potential Control Measures Not Currently in Use

Table II-3. ORGANIZATION OF DELPHI STUDY

Round	Overall "Attractiveness"	Implementation Obstacles	Effectiveness	Comments
One	First Iteration			Preliminary screening of the "best" (most attractive) control measures
Two	Second Iteration			Final selection of most attractive control measures
Three	Third Iteration			Ranking of overall attractiveness of control measures
Four	Fourth Iteration	First Iteration		Final consideration of overall attractiveness and first consideration of implementation obstacles
Five		Second Iteration		Reconsideration of ranking of implementation obstacles for most attractive control measures
Six			First Iteration	Ranking of control measures in terms of achieving specified objectives (effectiveness)
Seven			Second Iteration	Reconsideration of effectiveness rankings

As mentioned previously, an air quality maintenance plan consists of two distinct yet interacting elements--a land use control element and a technological control element. The Delphi panel served to identify the most promising measures for the land use control element. A cursory examination of the projected emission inventory for San Diego in 1985 reveals that the most significant sources of reactive hydrocarbon emissions are motorcycles, heavy-duty vehicles, aircraft, and light-duty vehicles. Since light-duty vehicles will be stringently controlled by that time, equity, as well as the technological limitations of deriving further reductions from source categories already under stringent control, argue in favor of attacking those sources that have not previously been subject to comparable control programs.

Therefore, the recommended maintenance strategy is summarized below:

Recommended Maintenance Strategy

Technological Control Element

- 90% reduction in heavy duty vehicle emissions
- 90% reduction in motorcycle emissions
- 90% reduction in aircraft emissions

Land Use Control Element

- Emission allocation procedure (SB 1543 or equivalent)
- Direct and indirect source review as well as EIS review (CEQA)
- Capital facility ordinances and development timing controls
- Taxation policy to preserve undeveloped areas

The land use control element must be implemented in a fashion that ensures that the Regional Comprehensive Plan policies (Table II-4) are observed over the next 10 to 20 years. Simultaneously, control programs must be designed to produce the emission reductions outlined. Should there be a failure in the technological control element to obtain the reductions needed, the burden of control will be shifted to the land use control element. The implication is clear: land use controls would then have to be enforced to limit growth in San Diego in order to maintain air quality.

Table II-4. REGIONAL COMPREHENSIVE PLAN POLICIES AND TRANSPORTATION PLANNING GUIDES

I The Regional Comprehensive Plan and local plans and programs should be directed specifically toward development and enhancement of existing urban communities and the maintenance and enhancement of rural communities within the region.

II New employment opportunities should be located in employment centers developed as an integral part of both existing communities and newly developing suburban communities. The size and number of the employment centers would depend on the size and character of the community within which they are located; the types of employment in each community employment center should be consistent with the availability and price range of housing in the surrounding community.

III Those activities that require Regional market or service areas should concentrate in employment and service centers. These centers should be located at the focal points of the Regional Transportation System.

IV Local jurisdiction should use the location of regional transit facilities as a focal point for local development plans for activities providing employment opportunities and for higher density residential development.

Transportation Planning Guides

- to emphasize consistency and coordination of overall regional growth and development policies with regional and local transit services
- to recognize the importance of multi-modal systems to serve the different travel requirements of the population
- to recommend a transportation plan that will minimize the region's energy requirements and maximize improvements in the air quality
- to provide transit services to low-mobility population segments, e.g., the elderly, the young
- to maximize opportunities for pedestrian and local feeder access to regional transit terminals and stations
- to make maximum advantage of the most advanced and proven automation equipment available
- to recommend that the regional transit system be an intermediate capacity, fixed guideway, transit network that operates on exclusive right-of-way, e.g., light rail, advanced technology transit
- to recommend an express bus network that provides high levels of transit services in medium level demand travel corridors.

VIII. Legal Authority

Existing legal authority for the implementation of the control measures is summarized in the table below:

Summary of Legal Authority

Measure	Implementation Agency	Authority
Heavy duty vehicle control	EPA ARB	Clean Air Act Mulford-Carroll Act[1]
Motorcycle control	EPA ARB	Clean Air Act Mulford-Carroll Act
Aircraft control	EPA	Clean Air Act
Emission Allocation	local agency	to be acquired
Direct source review	EPA ARB APCD	Clean Air Act Mulford-Carroll Act State Health & Safety Code
Indirect source review	EPA ARB local agency	Clean Air Act Clean Air Act delegated from EPA or ARB, pending legal clarification of present law
Environmental Impact Statement Review	ARB	California Environmental Quality Act[2]
Capital facility ordinances	regional special purpose agencies	Various
	local agencies	Zoning & building permit authority
Development Timing Controls	local agencies	to be acquired
Taxation policy to preserve undeveloped areas	local agencies	Williamson Land Conservation Act[3]

---

[1] A 1967 act that created the California Air Resources Board provides for retention at the state level, or delegation to Air Pollution Control Districts, of enforcement of controls.

[2] Enacted in 1970 and enhanced through subsequent California Supreme Court rulings, this act established procedural requirements for environmental impact reporting.

[3] A 1965 act designed to alleviate pressure for conversion of agricultural land and to preserve open space by preferential tax assessment based on the productive value of the land. Initiative for holding land for open space lies with the land owner. State pays a subvention to local government for a portion of foregone taxes.

Legal authority currently exists in one form or another for the implementation of each of the measures outlined, with the exception of the emission allocation procedure and the development timing controls. A bill (SB 1543) to provide the authority for emission allocation is currently before the State Senate, and it is conceivable that development timing control could be implemented through the building permit authority of local agencies.

SUMMARY OF SAN DIEGO AQMSA

POLLUTANT: TSP

NAAQ STANDARD: 60 ugm/m^3

CURRENT AIR QUALITY, 1972: 97 $\mu g/m^3$

EXPECTED AIR QUALITY IN 1975: 100 $\mu g/m^3$

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD BY 1975: 55% (assuming an uncontrolable background of 30 $\mu g/m^3$)

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

Removal of sulfur from gasoline (eliminating sulfuric acid aerosol) should be in effect by 1977.

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED:

Coordination between EPA, ARB and APCD.

SUMMARY OF SAN DIEGO AQMSA

POLLUTANT: CO

NAAQ STANDARD: 9 ppm (8-hr. average)

CURRENT AIR QUALITY, 1972: 19 ppm (8-hr. average)

EXPECTED AIR QUALITY IN 1977: 9 ppm (8-hr. average)

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD BY 1977: 53%

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

The promulgated EPA transportation control plan must be in effect by 1977:

- inspection/maintenance program
- Vacuum spark-advance disconnect (VSAD) retrofit for 1966-70 model year LDV
- oxidizing catalyst retrofit for 1966-74 model year LDV
- federal motor vehicle control program for new cars must proceed on schedule
- 11% VMT reduction due to exclusive bus/carpool lanes, carpool matching programs, and parking management plans

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED:

Coordination of overall program implementation between EPA, the State Air Resources Board and Department of Transportation, the San Diego County Air Pollution Control District, and the Comprehensive Planning Organization of the San Diego region. The State ARB must implement the inspection/maintenance program, the VSAD retrofit program, and the oxidizing catalyst retrofit program. EPA must ensure that the timetable for "clean" cars does not slip again. Finally, the California Department of Transportation (CalTrans) and the Comprehensive Planning Organization must plan and implement the exclusive bus/carpool lane program and the parking management program, respectively.

SUMMARY OF SAN DIEGO AQMSA

POLLUTANT: SO_x

NAAQ STANDARD: 365 $\mu g/m^3$ (24-hr. average)

CURRENT AIR QUALITY, 1972: 75 $\mu g/m^3$ (24-hr. average)

EXPECTED AIR QUALITY IN 1975: 114 $\mu g/m^3$ (24-hr. average)

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD BY 1975: none required

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT: NONE

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED: NONE

SUMMARY OF SAN DIEGO AQMSA

POLLUTANT: NO_x

NAAQ STANDARD: 60 μg/m^3 (annual arithmetic mean)

CURRENT AIR QUALITY (GIVE YEAR): 50 μg/m^3 (annual arithmetic mean)

EXPECTED AIR QUALITY IN 1975: 40 μg/m^3 (annual arithmetic mean)

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD BY 1975: none

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

Maintenance will be assured by the federal motor vehicle control program.

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED:

None

SUMMARY OF SAN DIEGO AQMSA

POLLUTANT: HC/ Photochemical Oxidants

NAAQ STANDARD: .08 ppm HC (1-hr. average)

CURRENT AIR QUALITY, 1972: .32 ppm HC (1-hr. average)

EXPECTED AIR QUALITY IN 1977: ~.15 - .20 ppm HC (1-hr. average)

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD BY 1977: 75%

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

- The promulgated EPA transportation control plan (see the summary sheet for CO) (1977)
- 90% reduction in motorcycle reactive hydrocarbons (RHC) emissions (1985)
- 90% reduction in heavy-duty vehicle RHC emissions (1985)
- 90% reduction in aircraft (both civilian and military) RHC emissions (1985)
- Land-use controls to ensure that the Controlled Trends Regional Comprehensive Plan policies are followed (1975)

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED:

Three alternative organizational structures have been identified as having the best potential for planning and implementation of the AQMP. One alternative has the Comprehensive Planning Organization (the local COG) taking the lead responsibility, while a second alternative has the County Air Pollution Control District taking the lead responsibility. A third alternative would have the CPO and the APCD share the lead role through the formation of a joint governing body. The key determinant of the structure to be employed is the delegation of indirect source review authority.

Chapter III

ST. LOUIS TRIAL AIR QUALITY MAINTENANCE PLAN*

I. AQMSA Description

St. Louis was chosen as an example Air Quality Maintenance Study Area (AQMSA) because it is an interstate, interregional Air Quality Control Region (AQCR) with a diversity of pollution sources and problems, and has an anticipated maintenance problem for particulates (TSP), sulfur oxides (SO_2), carbon monoxide (CO), and photochemical oxidants (O_x).

The St. Louis SMSA, which initially is considered to be coincident with the AQMSA, covers portions of Missouri and Illinois and comprises seven counties and one independent city (see Figure III-1). The majority of industrial pollution sources are located along the rivers that separate the two states. The prevailing winds (northwest in the winter, southwest in the summer) tend to transport the pollutants across the river boundary, from Missouri into Illinois.

II. Intergovernmental Cooperation

A. Agencies, Governments, and Groups Contacted in Preparation of the Example AQMP

The following agencies were contacted during the preparation of the sample plan.

1. Federal Agencies

EPA, Region VII, Region V

Interagency Work Group on Air Quality Maintenance

2. State Agencies

Missouri Department of Natural Resources

Missouri Air Conservation Commission (MACC)

Missouri Department of Highways

Illinois Environmental Protection Agency (IEPA)

---

*The bulk of the trial plan on which this digest is based was prepared by a contractor prior to the establishment by EPA of firm guidelines concerning the requirements for and acceptability of multi-phase maintenance or attainment/maintenance plans. Further, dates of compliance suggested in this trial plan are not concurred in by EPA, and do not comply with the requirements of 40 CFR 51.

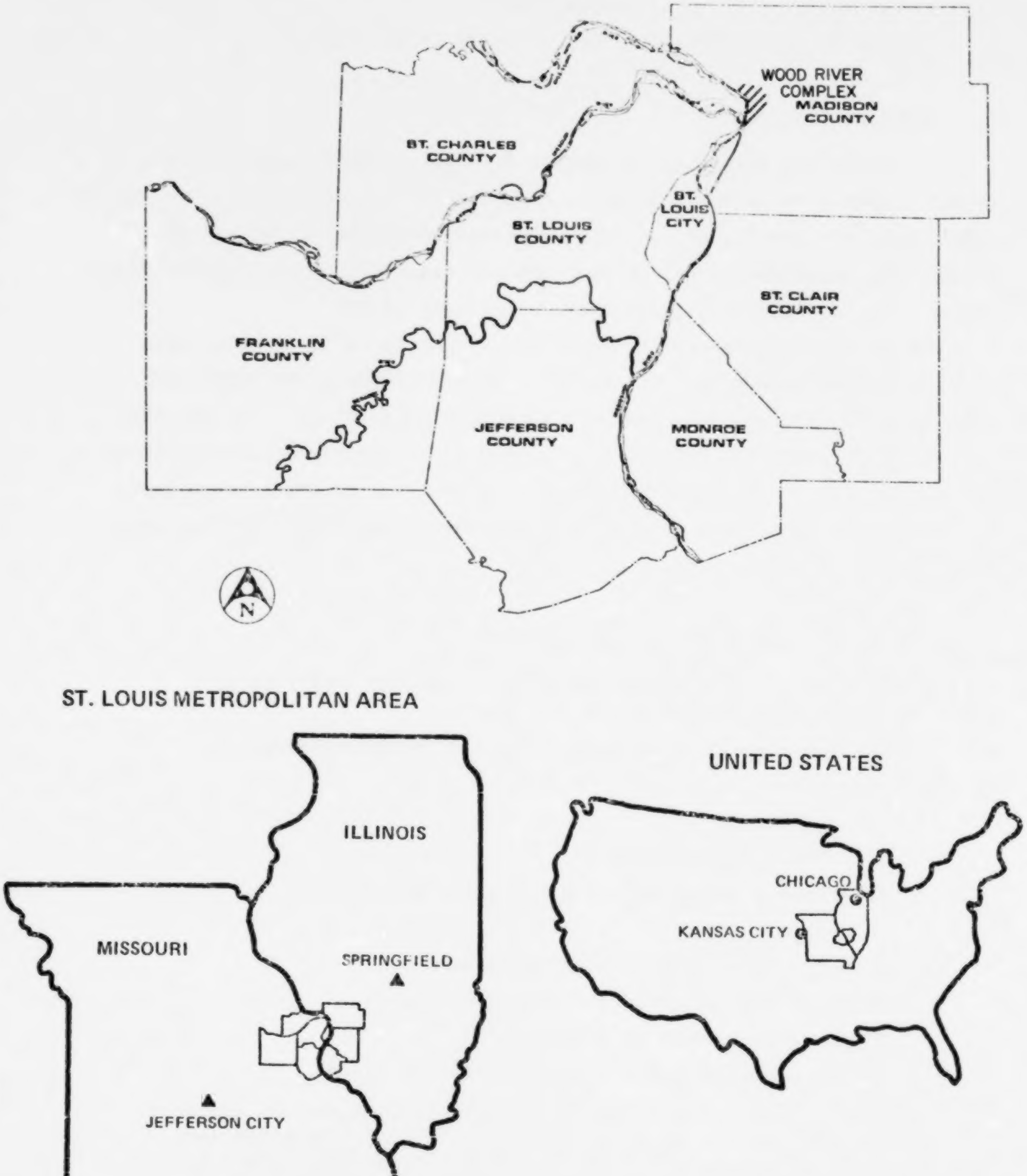

WOOD RIVER COMPLEX
MADISON COUNTY
ST. CHARLES COUNTY
ST. LOUIS CITY
ST. LOUIS COUNTY
ST. CLAIR COUNTY
FRANKLIN COUNTY
JEFFERSON COUNTY
MONROE COUNTY
N
ST. LOUIS METROPOLITAN AREA
ILLINOIS
MISSOURI
SPRINGFIELD
JEFFERSON CITY
UNITED STATES
CHICAGO
KANSAS CITY

Figure III-1. St. Louis Air Quality Maintenance Study Area

3. Regional Agencies

East-West Gateway Coordinating Council

Southwest Illinois Metropolitan Area Planning Commission

Bi-State Development Agency

4. Local Agencies

St. Louis County Air Pollution Control

St. Louis Division of Air Pollution Control (city)

St. Charles County Planning Commission

St. Louis City Planning Commission

Franklin County Planning Commission

St. Louis County Planning Commission

B. Existing Institutional Framework

The Air Quality Maintenance Plan consists of a set of goals, policies, and actions needed to preserve air quality. To be successful, this AQMP must be carefully integrated into the plan for the region and reflect the institutional framework for the area. In order to determine the most effective framework for intergovernmental cooperation, the existing institutional framework and coordination mechanisms were reviewed. The issues and constraints in the evaluation of alternative arrangements were examined, and a mechanism for coordinating AQMP implementation was selected as described below.

1. Existing Agency Responsibilities

The Air Quality Maintenance Plan can be considered to have three elements: source control, land use policies, and transportation policies. As shown in Figure III-2, the existing responsibility for these various elements is widely dispersed throughout the various jurisdictions involved, including the State and Federal government.

In the area of planning for source controls, the States, of course, have prime responsibility. In the case of land use, the primary responsibility lies with the city or county, while in the transportation field, it rests with the East-West Gateway Coordinating Council.

In the area of implementation, the primary responsibility for source control rests with the two states, although in Missouri, because of the competence available at the City of St. Louis and St. Louis County levels,

	JURISDICTION RESPONSIBLE					
POSSIBLE AQMP ELEMENT	FEDERAL	STATE	REGIONAL AGENCY	CITY	COUNTY	PRIVATE SECTOR
SOURCE CONTROL	○	● ■		○ ■	○ ■	□
LAND USE	○	○	○	● ■	● ■	□
TRANSPORTATION HIGHWAY	○	○ □ ■	●	○ □ ■	○ □ ■	
TRANSIT	○	○	● □ ■	○	○	

○ ADVISORY ROLE IN PLANNING FUNCTIONS
● PRIMARY RESPONSIBILITY FOR PLANNING FUNCTIONS
□ RESPONSIBILITY FOR PHYSICAL DEVELOPMENT
■ PRIMARY RESPONSIBILITY FOR CONTROL OR ENFORCEMENT

Figure III-2. Existing AQMSA Responsibilities

the State has assigned this responsibility to the air pollution agencies in those jurisdictions. In the area of land use, the primary responsibility for enforcing and controlling development rests with the city or the county, except the county does not have jurisdiction over incorporated areas within its boundaries. In the transportation field, the highways are primarily developed by the State for the major facilities, while minor facilities are provided by the city or county. In the transit area, major improvements are primarily developed by the Bi-State Development Agency, which is an interstate agency created some time ago primarily to develop a transit system. It operates the existing metropolitan (but interstate) area bus service.

In connection with the control or enforcement related to these transportation fields, the authority in the highway area rests with the State, the city, or the county. In the transit area, it primarily rests with the Bi-State Development Agency, although the East-West Gateway Coordinating Council is often consulted in connection with policy issues related to the operation of the system.

2. Existing Coordinating Mechanisms

The primary coordinating mechanism in the St. Louis metropolitan area is the East-West Gateway Coordinating Council. This Council was established about 10 years ago, primarily to respond to the highway requirement to set up a continuing, comprehensive, and cooperative planning process in the metropolitan area. Another responsibility that has been delegated to the East-West Gateway Coordinating Council is the so-called A-95 review. It requires that all Federal projects be reviewed by appropriate agencies that might be impacted by such projects.

Key political leaders in the metropolitan area are represented on the Council, and it is because of this representation that this Council can be influential. It seeks to get things done by review and persuasion. In an effort to further involve more people in the planning process, the Council has set up a series of committees, such as the Transportation Technical Committee, made up of the technical experts from various agencies and jurisdictions. In addition, there are citizen task forces, including transportation, solid waste, environment, criminal justice, and education.

In August 1974, the Missouri Air Conservation Commission established an Advisory Committee on Transportation Control. Figure III-3 shows the membership of this committee, which is responsible for advising the Commission on the development of a transportation control plan. It includes representatives of transportation agencies at the State and local levels, as well as certain planning and air pollution agencies. It also includes representatives from industry and from the public sector.

C. Alternative Arrangements for AQMP Development and Implementation

In developing an Air Quality Maintenance Plan, many issues and constraints related to its development must be resolved before an effective planning process can get underway. There are questions of who will be responsible for the technical work, how various elements will be related, and what roles the citizen and political leaders should play in the development of the plan. Alternative approaches to these issues are discussed in the following sections.

1. Technical Leadership

In the development of an Air Quality Maintenance Plan, the legal responsibility for the technical phase of the plan rests with the States. The Federal, regional, and local governments play an advisory role in plan development and the Federal government must approve the completed plan. Present patterns of responsibility in the St. Louis area indicate that the technical planning responsibilities could be moved toward the East-West Gateway Coordinating Council so that the Air Quality Maintenance Plan can be coordinated with other plans and goals for the region. For the long-range maintenance plan, implementation of transportation and land use measures could rest with the East-West Gateway Coordinating Council and the local jurisdictions, under the guidance of the State air pollution agency.

2. Participation

Participation in the long-term maintenance plan development and implementation must be looked at from three sectors--technical, political and public. Each is critical in developing intergovernmental cooperation.

Technical--The State air pollution agencies are responsible for the development of the Air Quality Maintenance Plan and are responsible for the implementation of it, although authority for implementation may be

TRANSPORTATION	MISSOURI DEPARTMENT OF TRANSPORTATION BI-STATE TRANSIT AUTHORITY EAST-WEST GATEWAY COORDINATING COUNCIL MISSOURI STATE HIGHWAY DEPARTMENT
INDUSTRY	ASSOCIATED INDUSTRIES OF MISSOURI
PUBLIC	WASHINGTON UNIVERSITY COALITION FOR THE ENVIRONMENT LEAGUE OF WOMEN VOTERS
PLANNING	EAST-WEST GATEWAY COORDINATING COUNCIL ST. CHARLES COUNTY PLANNING AND ZONING
TRAFFIC	ST. LOUIS COUNTY TRAFFIC CONTROL ST. LOUIS CITY TRAFFIC CONTROL
AIR POLLUTION	ST. LOUIS CITY AIR POLLUTION CONTROL ST. LOUIS COUNTY AIR POLLUTION CONTROL MISSOURI AIR CONSERVATION COMMISSION ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

Figure III-3. Missouri Air Conservation Commission Advisory Committee on Transportation Control

delegated to the local level, as has been done for the City of St. Louis and St. Louis County. However, if the plan is going to be successful, it should have considerable input from the local and regional agencies, not only in plan development, but in implementation as well.

At the present time, there is no machinery to involve the East-West Gateway Coordinating Council in AQMP development. The Missouri Air Conservation Commission Transportation Control Plan Task Force could be expanded to cover all elements of the Air Quality Maintenance Plan.

Participation in plan implementation, of course, is a very important issue, particularly in the land use area where the local jurisdiction is the only authority that can regulate land. It is not very likely that this power will be relinquished to a regional agency or to the State, although a State program of regional planning jurisdictions is an alternative.

Political--Political participation is very critical, since the implementation of the plan may not agree with local jurisdictional objectives. This political participation can be accomplished through the East-West Gateway Coordinating Council. A special task force of political leaders under the EWGCC might be set up to study air quality maintenance for the area. This task force could develop the regulations that will be needed for long-term plan implementation.

Public--It is becoming more and more apparent that any plan or program that has an impact upon the citizens should be developed through a public participation process. The earlier these kinds of programs are initiated, the better, even before any alternatives are developed. Certainly, the public should have a role in the development and evaluation of alternatives, and in making recommendations to the political leaders. At the present time, the East-West Gateway Coordinating Council has moved ahead in this direction by establishing public participation in its planning process. They now have a citizen task force on environment, and other appropriate groups could be formed.

D. Constraints to Intergovernmental Cooperation and Coordination

In discussing the issues related to coordination, it is quite clear that there are serious constraints to the development of a plan and the implementation of such a plan in the St. Louis area. These constraints include: time availability, funding, legal authority, and jurisdictional complexity.

1. Time

The June 1975 deadline for preparation of the AQMP makes difficult the development of adequate information, appropriate analyses of the data, and proper technical, public, and political participation.

2. Funding

Adequate funding is critical. No new source of funds is available to the air pollution control agencies for development or implementation of a long-term comprehensive plan. Furthermore, to have the greatest impact, some funds should be made available to the local jurisdictions, and particularly to the East-West Gateway Coordinating Council so that they can provide the staff to properly carry out their role in the planning process.

3. Legal Authority and Jurisdictional Complexity

At the present time, adequate legal authority exists to implement stationary source control and some transportation measures, although all such authority is not fully implemented or enforced. However, land use control authority has been delegated to the local governments. There is no area in the United States, and certainly not in St. Louis, that can be controlled by a regional authority. Therefore during the early stages--up to 1977 and 1980--the St. Louis area is going to have to depend upon persuasion to implement any regional land use program aimed at maintaining air quality.

If these persuasion approaches are done well, with thorough public and political participation, a great deal should be possible. While this is being implemented, the kinds of mandatory enforcement required to properly maintain the necessary air quality should be explored and investigated.

The jurisdictional complexity in the St. Louis area that has been discussed at several points in this presentation is similar to many areas throughout the country. Only a few areas, like Minneapolis-St. Paul and Nashville, Tennessee, have moved significantly toward ameliorating this problem by giving more and more powers to the regional agency. In the

St. Louis area it is recommended that more powers be given directly to the East-West Gateway Coordinating Council. Cooperative arrangements will be the cornerstone for regional improvements in the St. Louis area, and every effort will have to be made to find out how to use these cooperative agreements most effectively in dealing with air quality considerations. This will call for considerable public participation as well as political involvement. So, in effect, any sound program for air quality maintenance will depend on cooperative participation of the public, the political, and the technical leaders of the metropolitan area.

E. Recommended Arrangement for AQMP Development and Implementation

The significant conclusions from the St. Louis Study are as follows:

- Plan development and implementation must be phased
- Coordination mechanisms may vary with each phase to reflect significant changes in responsibility or new program developments
- Coordination mechanisms must reflect jurisdictional framework, legal authority, and time and funding constraints
- Special mechanisms are needed for coordination

The recommended responsibility of different agencies for the various phases is shown in Figure III-4. The timeframe and funding constraints for example AQMP preparation did not provide for the active participation of agencies other than the State and local air pollution agencies. Because land use planning and transportation planning agencies will not be able to actively participate at this stage, it is doubtful that appropriate control measures in these areas can be proposed in Phase 1.

The Transportation Control Plan Advisory Committee to the MACC has just been established after approximately one year of effort. This advisory committee can be expanded in membership and scope to initiate AQMP preparation or it can be replaced by an AQMP advisory committee appointed to be responsible for preparing alternative approaches for long-term AQMP plan development.

Phase 2 includes the timeframe from proposed AQMP submittal in June 1975 to the first AQMP review period in 1980. This time period

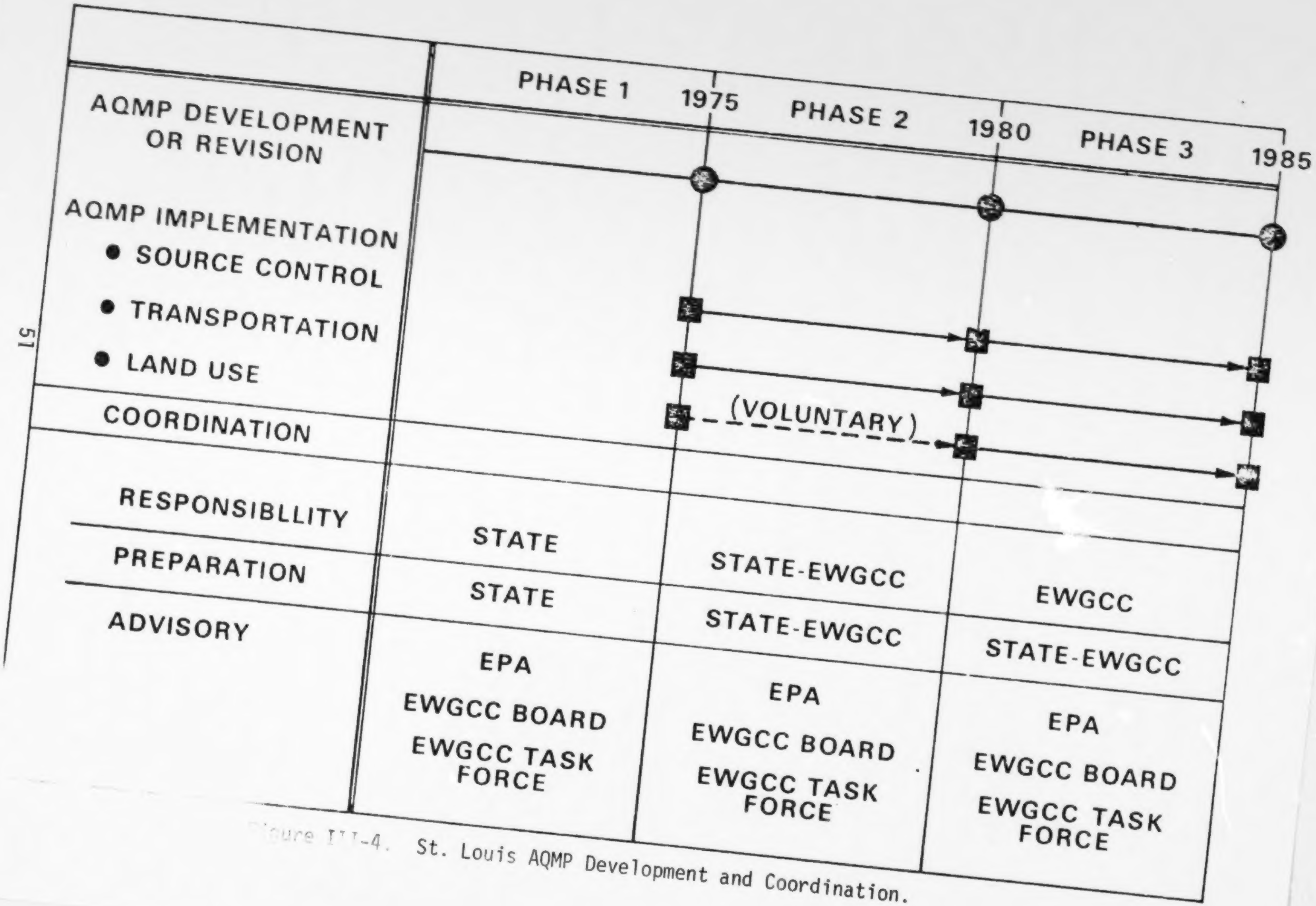

PHASE 1
1975
PHASE 2
1980
PHASE 3
1985
AQMP DEVELOPMENT OR REVISION
AQMP IMPLEMENTATION
● SOURCE CONTROL
● TRANSPORTATION
● LAND USE
COORDINATION
(VOLUNTARY)
RESPONSIBLLITY
PREPARATION
ADVISORY
STATE
STATE
EPA
EWGCC BOARD
EWGCC TASK FORCE
STATE-EWGCC
STATE-EWGCC
EPA
EWGCC BOARD
EWGCC TASK FORCE
EWGCC
STATE-EWGCC
EPA
EWGCC BOARD
EWGCC TASK FORCE

Figure III-4. St. Louis AQMP Development and Coordination.

includes revisions to the SIPs due to failure to attain any of the primary standards by the proposed attainment dates and incorporation of the Transportation Control Plan. The State air pollution control agencies will provide the primary technical leadership for SIP revisions during this phase.

During this phase, the AQMP should be revised to include the land use and transportation considerations. Therefore the EWGCC is recommended as the agency responsible for this first major revision of the AQMP and for subsequent revisions and updates of the AQMP required as a continuing process. Within this framework, the two states would retain approval authority and State and local air pollution agencies would provide expert assistance during the planning process. Responsibility for implementation and enforcement would remain with the two states and authority could be delegated to lower jurisdictions in accordance with policy.

Phase 3 represents the ongoing 5-year review and revision cycle. At this point, it is assumed that all available source control technology will have been implemented and the emphasis in air quality maintenance will be on land use and transportation alternatives. Therefore with EWGCC performing as the technical coordinator for AQMP revisions, the State Air Pollution Control Agencies could then concentrate efforts on new technology and source control programs, and enforcement of existing programs.

III. Baseline Emissions Inventory

A. Baseline Year

Existing inventory data in the St. Louis Air Quality Maintenance Study Area were found to vary both in the year-of-record for a particular source type and in completeness of information. To overcome the variation in year-of-record, existing 1970, 1972, or 1974 inventories were projected to 1975 (year of attainment) for each pollutant. This procedure aligns all emissions data to a baseline year (1975) and assumes that all sources will be in compliance with existing controls by the 1975 attainment date. To eliminate discontinuities in information, existing data were supplemented by special analyses, as listed in the following section, to provide a complete data base.

B. Sources of Emissions Data

The information used in the development of the baseline emission inventory was extracted from the following sources:

- Illinois State Implementation Plan
- Missouri State Implementation Plan
- Environmental Protection Agency--National Emissions Data System (NEDS)
- East-West Gateway Coordinating Council 1970 and 1995 Traffic Assignment Data
- "Study of Attainment of National Air Quality Standards for Carbon Monoxide and Oxidants in the St. Louis Air Quality Control Region," prepared by PEDCo Environmental Specialists, (cited hereafter as the Attainment Study)
- Union Electric Company and Illinois Power Company
- Bureau of Economic Analysis (BEA) statistics
- St. Louis Standard Metropolitan Statistical Area (SMSA) statistics

The special analyses undertaken were:

- Primary Source Emissions at Compliance (TSP, SO_2)
- Point and area source distribution (for TSP and SO_2 only)
- Subcorridor-VMT emission analysis (for CO and HC only)

The primary source emissions at compliance for TSP and SO_2 were supplied by the MACC and IEPA. Emissions at compliance for CO and HC primary sources were taken from the Attainment Study (as corrected by IEPA).

C. Geographic Location of Sources

The NEDS inventory lists the location of point sources in UTM coordinates. Area source data has been gridded in previous studies of the St. Louis area using Illinois State Plane Coordinates. The detailed land use data provided by the EWGCC are also maintained in a grid based on the Illinois State Plane System.

A UTM-based grid network prepared by the CAASE procedure for area source emission distribution was available from EPA for the St. Louis Interstate AQCR and was used as an analysis base. In order to reduce the number of area source grid squares used in computations, the smallest of the grid squares (1 km x 1 km) were combined into larger area sources. The area of each grid square occupied by various categories of land use was determined by overlaying the grid on land use maps, and these were used to disaggregate NEDS county total area source data to the grid squares.

Since the point source coordinates were already UTM, they were easily transferred to the grid location.

D. Technical Assumptions about Existing and Future Source Control

It was assumed that all primary point sources would meet their compliance schedules. It was further assumed that these sources would not emit less than the stated emissions at compliance in 1975. This was considered a conservative estimate. No additional controls were applied beyond those already in the SIP.

Many new controls or regulations are currently under study or are proposed. These include: Indirect Sources Review, New Source Performance Standards, significant deterioration regulations, fine-particle regulations, and changes or delays in the Federal Motor Vehicle Control Program. As these programs and their specific application to sources are defined, their impact on emissions reduction can be quantified. However, at present, it was felt that it would be most conservative to assume no additional reduction from those programs.* Such programs can then be examined for application as maintenance measures.

E. Problems and Suggested Solutions

Several detailed studies of air pollution in the St. Louis area have been completed over the last ten years. However, a review of available emissions data showed that there exists no consistent, current emissions data for all sources in the AQMSA that are suitable for modeling purposes.

For example, the year-of-record varied for point source data and the 1972 NEDS listing was considered inaccurate or incomplete for point and area sources in both Missouri and Illinois. All area source data are on a county-wide level, which is too gross for models that show spatial variations. Gridded area source emissions were available from older studies, but had not been updated and did not agree with the data in NEDS.

---

*While this is indeed a conservative assumption with regard to possible but not certain improvements in air quality, EPA policy accepts and encourages realistic appraisal and consideration of the effects of all programs now in force for the prevention of emissions from new or modified sources.--Editor.

It is recommended that data be collected in a format suitable for modeling. The RAPS program will provide data on a subcounty basis. It is expected that these data will be distributed into the CAASE grid. It is recommended that the subcounty level of detail be maintained in updating the emissions inventory. This will provide a spatially detailed data base sufficient for modeling purposes.

The MACC is currently coordinating efforts to update the point source inventory for modeling purposes. The IEPA is working on a program to convert their inventory to NEDS format.

IV. Emission Projections

A. General Methodology

The general approach to projecting emissions for all four pollutants applied the following procedure:

1. Estimate a 1975 baseline inventory of all sources assuming the sources are in compliance with existing regulations
2. Develop growth factors for each source category from available growth data
3. Apply the growth factors to the 1975 baseline inventory to obtain projected emissions from each source category.

Emissions were projected for four source categories: point, area, power plants, and mobile sources. The specific methodology applied to each source category is discussed in the following sections.

1. Point Sources

The 1975 point source emissions data were broken down into primary (sources greater than 100 tons/year) and non-primary (sources identifiable as points, but less than 100 tons/year) sources for each pollutant. For the primary point sources for TSP and SO_x, summaries of source emissions at compliance, prepared by the Illinois Environmental Protection Agency and the Missouri Air Conservation Commission, were used. For the non-primary source emissions, the emissions were assumed to be uncontrolled (except as stated in the SIP) and were taken from NEDS. The CO and HC 1975 point source emissions were taken from the Attainment Study (as corrected by Illinois EPA).

The method for projecting point source emissions for 1980 and 1985 was to obtain growth rates for each company, power plant, and industry that represents a primary point source. BEA industrial growth statistics were used for non-primary point sources. Accordingly, a survey was conducted of the primary point sources to gather information on growth rates, productivity increase estimates, and expected increases in capacity. Where actual growth rates could not be obtained for a point source, projections were made using BEA statistics on growth in industrial earnings and SMSA statistics on growth in employment and population.

2. Area Sources

1970, 1972, and 1974 area source emissions data were gathered and projected to 1975 by applying a) the percent emission control as required by the State Implementation Plan and b) growth factors from BEA statistics for each area source category. 1980 and 1985 growth rates were calculated from BEA growth statistics and local population estimates.

3. Power Plants

Individual plant data were provided by Union Electric Company, Illinois Power Company, Missouri Air Conservation Commission, and the Illinois Environmental Protection Agency. To project power plant emissions for 1980 and 1985, the growth factors and the scheduled changes in new and old plants were applied to 1975 baseline controlled emissions.

4. Mobile Sources

Mobile source emissions were divided into two categories: highway and off-highway vehicles. Highway vehicles include both light- and heavy-duty vehicles; off-highway vehicles include railroads, vessels, aircraft, and other vehicles not operated on roads. For highway vehicles, mobile source emissions data were taken from the Attainment Study for the baseline year of 1975. For off-highway vehicles, mobile source emissions data were taken from NEDS and the Missouri and Illinois State Implementation Plans. Off-highway emissions were projected using a 3 percent average growth rate.

Highway emissions for TSP and SO_x were generated by applying TSP and SO_x emissions factors to projected annual VMT. Highway mobile source CO and HC emissions for 1980 were taken from the Attainment Study for the Air Quality Control Region and adjusted to the Air Quality Maintenance Study Area. The 1985 emissions were calculated in a special analysis (subcorridor VMT Emission Analysis) for the St. Louis urban-in-fact area by interpolating the 1970 and 1995 traffic network data for each subcorridor and link type. These emissions were adjusted to account for the entire Air Quality Maintenance Study Area by the ratio of the projected VMT in the AQMSA to the projected VMT in the urban-in-fact area. A summary of projected emissions is shown on table III-1.

B. Problems and Recommendations for Solutions

In order to obtain a consistent controlled data base from which to project 1980 and 1985 emissions and air quality, the available data on emissions sources were first projected to 1975 to obtain the inventory at full compliance with SIP regulations. This assumes that all sources will be in compliance by 1975. The "controlled inventory" was then projected to 1980 and 1985 using available growth and trend data.

The growth factors were based on population trends, employment and industrial earnings projections, and traffic projections. Land use and distribution trends were used to distribute the projected growth in emissions. The use of such trend data as growth factors first assumes that growth in emissions is directly proportional to these growth factors. Although new and more efficient manufacturing techniques and control equipment may make this assumption inaccurate, the procedure was deemed appropriate for use in this pilot study.

Population forecasts served as growth and distribution factors. The latest (unpublished) estimates show a marked decrease in population growth compared to previously available projections for the urban area. Since the land use plans do not as yet reflect this change, this represents a source of error that should be considered in the future application of this report. The land use plans also represent projected patterns of industrial and commercial growth and development.

There are four studies currently under way that could significantly alter the growth patterns in the area. They are:

Table III-1

ST. LOUIS AIR QUALITY MAINTENANCE STUDY AREA
EMISSION PROJECTION - SUMMARY

Source Category		Emissions, Tons per year		
		1975	1980	1985
		Total Suspended Particulate		
Point Sources		50,329	57,972	71,617
Area Sources		18,955	20,404	23,563
Power Plants		20,348	34,064	34,863
Mobile Sources:	Highway	8,383	9,622	10,823
	Off-highway	3,647	4,228	4,902
	TOTALS	101,662	126,290	145,768
		Sulfur Dioxide		
Point Sources		194,046	204,013	218,452
Area Sources		40,155	44,510	50,063
Power Plants		577,190	864,748	873,000
Mobile Sources:	Highway	2,065	2,371	2,666
	Off-highway	3,624	4,202	4,872
	TOTALS	797,080	1,119,844	1149,053
		Carbon Monoxide		
Point Sources		46,821	50,870	59,734
Area Sources		28,808	27,565	27,799
Power Plants		1,641	1,641	1,700
Mobile Sources:	Highway	476,242	241,459	146,070
	Off-highway	31,891	36,972	42,859
	TOTALS	585,403	358,507	278,162
		Hydrocarbons		
Point Sources		40,208	50,330	55,009
Area Sources		30,389	32,153	35,370
Power Plants		1,191	1,395	1,666
Mobile Sources:	Highway	82,502	39,217	25,956
	Off-highway	11,217	13,004	15,076
	TOTALS	165,507	136,009	133,085

- A railroad relocation study
- An airport study
- A port feasibility study
- A mass transportation plan

These plans will not be complete within the time frame for initial AQMP submittal. This represents a potential inaccuracy in the projections.

It is recommended that the impact studies on current major projects be used to update the projections of emissions as they become available. The population projections will be reflected in the update of the regional comprehensive plan and the HUD 701 Plan updates, and should be used to revise the estimated projections and distribution of emissions.

The industrial survey technique was recommended as the best approach for obtaining short-term growth estimates for existing primary sources.

The growth factors such as population trends, employment, industrial growth and distribution data are available on a detailed spatial scale in the regional land use plans. However, the format and frequency for updating these data is not currently compatible with emissions inventories. It is recommended that the EWGCC, MACC, and IEPA cooperate to obtain growth data in a format useful for projecting emissions. EWGCC attempts to evaluate alternative comprehensive plans for air quality impact may provide a means of coordinating these data bases.

V. Establishment of Baseline Air Quality

A. Baseline Year and Sources of Data

1972 was used as the baseline year for air quality because 1973 SAROAD summaries were not available at the start of this study. Monitoring data from 11 stations in the AQMSA were reviewed. Trend calculations were available from selected sites from the Plan Revision Management System Summary Report.

B. Compatibility of Baseline Emissions and Air Quality Data

The emissions inventory used as a baseline was determined from activity projections to 1975 and assumed all sources to be in compliance with now existing regulations of the appropriate state. These data, of course, are not compatible with the 1972 air quality data. However, some air quality models for non-reactive pollutants had been calibrated using concurrent emissions and air quality data. These calibrated models were applied to the 1975 projected emissions to estimate expected air quality. Since oxidants result from reactions in the atmosphere, modeling is not possible. Therefore, Appendix J was applied to 1972 emissions data to determine the HC emission reduction required, and the maximum allowable emissior

C. Accuracy and Representativeness of Data

The Illinois monitoring data were not in the SAROAD data bank in 1972. The IEPA considers the 1973 data to be more reliable due to improved monitoring capabilities and techniques. The 1973 data will be entered into SAROAD.

The 1972 monitoring network on the Missouri side is extensive for TSP and SO_2. However, it cannot be considered representative of the AQMA because of the more significant source problem in the East St. Louis and Wood River areas.

The Missouri Carbon Monoxide Monitoring Network has recently been expanded to provide more data. Sites were selected to be representative of areas that are expected to show maximum concentrations due to mobile sources.

D. Estimation of Air Quality from Monitoring Data

Existing air quality data and initial air quality projections were reviewed by the Missouri Air Conservation Commission (MACC) and by the Illinois Environmental Protection Agency (IEPA) in order to designate the St. Louis Air Quality Maintenance Study Area.

Trend calculations from selected sites were available for total suspended particulates, sulfur dioxide, carbon monoxide, and oxidants from the Plant Revision Management System (PRMS) Summary reports. Results of the trend analysis indicate that most of the TSP problems are related to the 24 hour standard. Three sites were identified as "potential problems." One major "potential problem" with respect to CO was identified near downtown St. Louis. An oxidant problem appeared at four sites distributed throughout the AQMSA.

The following statements summarize the conclusions from the review of all existing air quality data for the St. Louis AQMSA:

- TSP, SO_2, CO, and oxidants all currently exceed the primary standards at some point in the AQMSA
- TSP and oxidants exceed the criteria for designation of a maintenance problem
- SO_2 currently exceeds the standards in isolated areas in both the Illinois and Missouri portions of the AQMSA.
- CO does not exceed the criteria for designation of a maintenance area.

E. Problems and Suggested Solutions

Monitoring data from 11 stations in the AQMSA were reviewed. The Regional Air Pollution Study (RAPS) will add 25 new monitoring stations to this network during the next two years. It is recommended that priority be given to analyzing data from the sites in the vicinity of Wood River and East St. Louis to verify the short-term SO_2 problems.

VI. Air Quality Projections

A. Methodology

Certain general considerations guided the selection of projection techniques. These considerations included the availability of techniques recently applied to St. Louis where forecasts need only be extended to longer time intervals, the availability of a calibrated model for St. Louis based on current data, the availability of data to facilitate the application of a specific technique, and the time constraints posed by this particular study.

Those techniques selected for projecting air quality for total suspended particulates, sulfur dioxide, carbon monoxide, and photochemical oxidants are discussed in the following sections.

1. Total Suspended Particulates

The estimation of annual concentrations for TSP was accomplished through application of statistical relationships between TSP emission density and concentration.* The relationship is displayed as a curve (where 1964 TSP sampling data are plotted against emissions densities for various land areas larger than 20 square miles).

---

*U.S. Department of Health, Education, and Welfare, Interstate Air Pollution Study: Phase II Project Report, December 1966.

The air quality estimation method required the summary of emissions from all sources within selected subareas (36 square miles or greater) of the St. Louis AQMA and then, determination of emissions density values for each subarea. The estimated annual concentration was then found from the curve and recorded at the center of each selected subarea in the AQMA. Isopleths were drawn between subarea centers. These isopleths display the mean annual TSP concentration distribution in the St. Louis AQMA. This procedure was applied to projected emissions for 1975, 1980, and 1985.

2. Sulfur Dioxide

The estimation of air quality concentrations for SO_2 was accomplished by applying two air quality diffusion models: Miller-Holzworth for the St. Louis central urban area and Wood River Complex Area, and Pasquill-Gifford Plume Dispersion for four significant point sources.

These two methods required calculation of concentrations from given equations. The Miller-Holzworth equation calculates annual average areawide concentrations of SO_2 from emissions density, mixing depth, urban size, and mean annual wind speed. The Pasquill-Gifford Plume Dispersion calculates a maximum 24-hour average concentration of SO_2 from wind speed, plume rise, emissions rate, stack parameters, meteorological stability, and assumes a Gaussian plume. The resulting concentrations, tabulated for 1975, 1980, and 1985, obtained by applying the models to the projected emissions for those years, are included in the full text report.

3. Carbon Monoxide

As recently as March 1974, the APRAC 1A Diffusion Model had been applied to projected carbon monoxide emissions for the St. Louis AQCR (the Attainment Study). However, estimates of 8-hour CO concentrations were only calculated for 1975. CO concentrations in 1980 and 1985 were extrapolated from the 1975 estimates using the following procedure:

- Assume worst case meteorological conditions; do not vary
- Assume concentrations of CO are directly proportional to emissions of CO under constant worst-case meteorological conditions
- Calculate 1975, 1980, and 1985 CO emissions in the vicinity of the selected 9 receptors using the subcorridor VMT analysis
- Calculate the change in emissions in the vicinity of each receptor from 1975 to 1980, and 1980 to 1985 by subtraction.

Apply the corresponding percent change in emissions to the 1975 concentrations at each receptor to obtain 1980 and 1985 concentrations.

This procedure is equivalent to a "roll-foward" type of calculation using the results of a calibrated diffusion model to represent baseline air quality.

4. Photochemical Oxidants

The 1972 second highest 1-hour oxidant concentration of 300 micrograms per cubic meter was used with Appendix J of Regulations on Preparing Implementation Plans (40 CFR 51) to determine the percent reduction in hydrocarbon emissions needed to reduce photochemical oxidant concentrations to the NAAQS. This percentage reduction was applied to the 1972 total hydrocarbon emissions to determine the amount of emissions that must be prevented. Subtracting this amount from the 1972 total gave the maximum hydrocarbon emissions allowable if the photochemical oxidant standards are to be maintained. The maximum allowable total hydrocarbon emissions value applies to any year. This reduced hydrocarbon emissions value was then used to determine the reduction required in projected emissions for 1975, 1980, and 1985 to maintain NAAQS. A summary of the air quality projections for 1975, 1980, and 1985 is shown in table III-2.

B. Summary and Conclusions of the AWMSA Analyses

The conclusions of the air quality and emissions analyses follow for each pollutant considered.

1. Total Suspended Particulates (TSP)

Air Quality--Ambient concentrations currently exceed the primary standards at several monitoring stations. The projected concentration distribution pattern changes very little over the 10-year period. "Hot-spot" areas can be identified that have the potential to exceed the standards during the 1975 to 1985 period.

Source Contribution--Point sources and power plants are the primary contributors to the existing problem. However, increases are projected in all source categories. Growth in emissions is expected to be concentrated at existing sources or in the vicinity of existing sources. Growth between 1974 and 1985 accounts for less than 20 percent of projected total emissions in 1985. The contribution of fugitive dust to ambient concentrations is not known at this time.

Attainment and Maintenance of Standards--The primary standards are projected to be attained by 1975 and maintained throughout the following 10-year period in most of the AQMSA. However, "hot-spot" areas are identified

Table III-2

ST. LOUIS AQMSA
SUMMARY OF AIR QUALITY PROJECTIONS

Pollutant	Averaging Time	Peak Concentrations 1975	1980	1985
TSP ($\mu g/m^3$)	Annual (std. = 75)	120	120	120
SO_2 ($\mu g/m^3$)	24-hr. (std. = 365)	322	400	400
CO (ppm)	8-hr. (std. = 9)	12.8	6.95	4.30
O_x ($\mu g/m^3$)	1-hr. (std. = 160)	240	190	180

where the primary standards are projected to be exceeded beyond the 1975 compliance schedule. Because the growth in emissions is projected to be concentrated in these "hot-spot" areas, maintenance of the standards will be a problem. Secondary standards are projected to be exceeded throughout the 10-year period in large portions of 3 counties and the city of St. Louis surrounding the "hot-spot" areas.

Actions Required--An attainment and maintenance strategy is required for the "hot-spot" areas. A strategy is needed to maintain the secondary standard for TSP in the area immediately surrounding the "hot-spots".

2. Sulfur Dioxide (SO_2)

Air Quality--Ambient concentrations of SO_2 at isolated sites in both the Illinois and Missouri portions of the AQMSA currently exceed the primary standard. Air quality projections are highly dependent on the sulfur oxide emissions from isolated sources and indicate that a "potential" to exceed the standards exists only in the vicinity of these sources.

Attainment and Maintenance of Standards--SO_2 standards are being exceeded in the vicinity of major power plants or specific point sources.

Actions Required--More extensive monitoring and surveillance of major sources is required to ensure maintenance of the short-term standards in the vicinity of these sources. Strict enforcement of existing regulations is required to prevent increases in SO_2 emissions from existing sources or prevention of new sources in the "hot-spot" areas.

3. Carbon Monoxide (CO)

Air Quality--Eight-hour standards are currently exceeded at several monitoring stations throughout the AQMSA. Projected concentrations indicate several areas will exceed the eight-hour standard in 1975. All selected receptor sites are projected to be well below the standards by 1980. Maximum concentrations are associated with major highways and intersections.

Source Contribution--Mobile sources are the primary contributors to CO emissions in the AQMSA and will still account for more than 50 percent of total emissions by 1985.

Attainment and Maintenance of Standards--Once the 8-hour CO standards are attained, the continued decline in mobile source emissions will assure maintenance to at least 1985.

Actions Required--A Transportation Control Plan (TCP) is currently in preparation to provide attainment of the CO standards. This will be incorporated in the AQMP.

4. Photochemical Oxidants (O_x)

Air Quality--Peak-hour oxidant concentrations currently exceed the standard and limited air quality trend data indicate increasing values. Oxidant values are projected to decrease due to decreases in total hydrocarbon emissions. However, the decreases are projected to be insufficient to attain the standard through 1985.

Source Contribution--Mobile sources are currently the most significant contributor to total regional hydrocarbon emissions. However, stationary point and area sources become more significant by 1985 as mobile source controls become more effective.

Attainment and Maintenance of Standards--The oxidant standard cannot be attained or maintained with the existing SIP control measures. Uncontrolled (no TCP) projected oxidant concentrations exceed the standard beyond 1985.

Actions Required--A Transportation Control Plan (TCP) is required for Attainment and a Maintenance Strategy is required.

C. Problems and Suggestions

The major drawback to using any sophisticated modeling procedures at this time is the inconsistency and inaccuracy in the emissions data base and the uncertainty of the demographic growth rate data. As these deficiencies are resolved, an effort should be made to coordinate the collection of data in a form useful for input to the analysis techniques. Point source data are currently collected in a form suitable for input to models for particulates and SO_2. However, more short-term operational data would be useful. Area source data for these two pollutants are not collected on a sufficiently detailed scale to input to a model such as AQDM or CDM. The CAASE program may provide adequate detail. Fugitive dust emissions must also be collected for input to the model for particulates.

Projected mobile source emissions data are currently available only on a county basis and are not suitable for input to any carbon monoxide air quality model. Data should be obtained in a format suitable for input to such models as SAPOLLUT and APRAC-1A.

The results of the RAPS program will be invaluable to upgrading the emissions inventory and analysis procedures for the St. Louis area. However, they will not be available within the proposed timeframe for AQMP submittal. Therefore, interim analysis approaches must be used. It is recommended that priority for all such interim analyses be given to the "hot-spot" areas.

VII. Selection of Maintenance Strategies

The air quality analysis indicates that attainment of the primary standards for TSP, SO_2, CO, and oxidants cannot be achieved by 1975. In addition, maintenance strategies are required for TSP, SO_2, and oxidants. The development of a maintenance strategy, therefore, requires a review of existing and proposed attainment plans and an evaluation of alternative maintenance strategies. The following sections provide a brief review of the status of attainment plans and the evaluation of alternative maintenance measures. A proposed maintenance strategy is outlined and the constraints to implementation of the selected strategy are described.

A. Status of Attainment Plans

1. Particulates

Current trends in air quality indicate the particulate standards will not be attained by 1975; the cause of this trend cannot be isolated. Therefore, no new attainment measures can be justified unless 1975 ambient data confirm this trend. Monitoring and surveillance programs are currently being expanded in order to verify the effectiveness of the existing attainment plan. It is recommended that a fugitive dust inventory be completed as a part of this monitoring program.

It would not be justifiable to require additional TSP control measures to attain the standards at this time until it can be determined whether the existing controls are being implemented to their intended extent and are achieving the expected results. Therefore, the only additional attainment measures recommended at this time are measures directed at expanding the monitoring and surveillance programs.

Compliance schedules and source review procedures are currently being reviewed by EPA and State air pollution agencies. The City of St. Louis has increased the frequency of monitoring in order to provide a more accurate assessment of ambient air quality. Monitoring has also been expanded in Illinois. In addition, the RAPS program will eventually provide detailed ambient data and emissions data to determine the relationship between emissions and ambient concentrations.

The City of St. Louis has also compiled a list of sources of particulates not included in the existing inventory, but does not have emission data for these sources. This program could be expanded to include a regionwide compilation of "fugitive dust" emissions.

2. Sulfur Dioxide (SO_2)

The SIPs for Illinois and Missouri both project attainment of the primary SO_2 standards by 1975. However, 1972 air quality exceeded the primary standards at several sites in the Illinois portion of the AQMA. The Illinois EPA feels these violations are related to individual sources.

The analysis concluded that the primary standards would not be attained by 1975 at several points in the AQMSA due to source-oriented problems. In addition, anticipated increased emissions from steam electric power generation provide the "potential" for short-term standards to be violated depending upon individual source operational characteristics.

It is concluded that attainment of the SO_2 standards is a specific source oriented problem and efforts are currently underway to determine source compliance with existing regulations. However, IEPA has designated their portion of the AQMSA for SO_2.

3. Carbon Monoxide and Photochemical Oxidants

St. Louis was not among the original group of cities required to submit transportation control plants to attain and maintain the NAAQS for CO and oxidants. Recent ambient data from the expanded monitoring network suggest an attainment problem does exist for CO and oxidants. Therefore, the MACC in cooperation with the Illinois EPA and the EWGCC augmented by additional community representatives is currently preparing a Transportation Control Plan (TCP).

It is assumed that the strategy selected will provide for attainment of the CO and oxidant standards by 1977 as required by the Clean Air Act provision. The strategy selected will greatly affect the maintenance of the oxidant standard due to the impact on growth in hydrocarbon emissions. The attainment dates and long-term maintenance impacts cannot be evaluated until the TCP is finalized.

B. Maintenance Strategy Selection

The maintenance strategy must provide sufficient emission reduction to account for the projected growth or plan for appropriate growth in areas where the ambient air quality is at or near the standards.

The maintenance problem in the St. Louis AQMSA is characterized by a number of areas where existing sources are expected to continue to emit pollutants at rates that virtually preclude the influx of additional emission sources into these areas without violation of ambient air quality standards once they are attained. Maintenance strategies for these areas must include further emission reductions from the existing sources and/or effective methods of preventing new sources from locating in these areas.

The potential maintenance strategies outlined in Volume 3 of the guidelines series were reviewed and evaluated for application in the St. Louis AQMA. Those measures considered generally applicable to the St. Louis Maintenance problems were evaluated for:

- long-term effectiveness
- effectiveness in preventing the location of new sources in "hot-spot" areas
- general application to the potential problem or "hot-spot" areas
- implementation obstacles

The conclusions of this review are as follows:

- Long-term air quality maintenance requires a regionwide, comprehensive approach associated with the community planning process. Two administrative approaches appear applicable and implementable--Emissions Allocation and Regional Development Planning.
- Measures that have long-term general application and effectiveness as part of a comprehensive approach include: indirect source review and environmental impact statements, transportation control measures, indirect regulatory controls, Federal New Source Performance Standards.

- Emission source control measures that have short-term or long-term effectiveness in the "hot-spot" areas include: more stringent controls on existing sources, phaseout of emission sources, control of fugitive dust.

C. Proposed Attainment/Maintenance Strategy

The air quality analysis, status of attainment plans, and evaluation of maintenance strategy alternatives indicate that the best available approach to the attainment and maintenance of air quality in the St. Louis AQMA is a program that includes:

- Full implementation and enforcement of all attainment plan measures included in the state implementation plans
- Expanded monitoring and surveillance through the RAPS/RAMS programs
- A Transportation Control Plan (TCP)
- Long-term comprehensive planning approach to air quality maintenance
- Interim measures to ensure maintenance during the period required for development and full implementation of the long-term plan.

A summary of the proposed plan elements for each pollutant is shown in Table III-3.

D. Constraints and Timetables for Development and Implementation of Air Quality Maintenance Plan

The major feature of the proposed maintenance strategy is a comprehensive approach that incorporates air quality maintenance into the community planning process. There are many issues and constraints that must be resolved before such an approach can be implemented. Discussions with planning community and air pollution agency representatives suggested that the interagency coordination required to implement a long-term comprehensive approach would take two to three years to establish (see Section II). If a formal or mandatory control program, such as emissions allocation, is selected as the desired administrative approach, some additional legal authority will be required in order to implement this program on a regional basis. The conclusion is that the comprehensive approach cannot be fully implemented for three to five years and "stop-gap" measures are therefore required to maintain the standards during the interim period.

Table III-3

PROPOSED ATTAINMENT/MAINTENANCE PLAN

	Attainment	Interim Maintenance	Long-Term Maintenance
Total Suspended Particulates (TSP)	SIP Regulations enforcement, extended monitoring and surveillance	Implement "hot-spot" regulations	Long-term comprehensive approach
Sulfur Dioxide (SO_2)	Enforcement of SIP Regulations, extended monitoring and surveillance	Implement "hot-spot" regulations, municipal refuse in power plants, SO_2 reduction at power plants	Long-term comprehensive approach
Carbon Monoxide (CO)	Transportation Control Plan (TCP)	(Required if TCP Strategy II or III are not implemented).* Indirect Source Review, Exclusive Bus/Carpool lanes	Long-term comprehensive approach
Photochemical Oxidants (O_x)	Transportation Control Plan (TCP)	(Required if TCP Strategy III not implemented) Cost-effective HC Stationary Source Control	Long-term comprehensive approach

---

*TCP Strategy II requires control of stationary sources of CO emissions in addition to reduction of VMT through carpooling, etc. Strategy III includes best technology control of stationary sources of HC emissions.

It is therefore recommended that the development and implementation of the maintenance plan be phased. Figure III-5 shows the suggested timetable for development and implementation of the comprehensive air quality maintenance plan. The key milestones are indicated.

There are three major phases shown for AQMP development and implementation:

- Phase 1 - now to June 1975
- Phase 2 - June 1975 to June 1980
- Phase 3 - June 1980 to June 1985

During Phase 1, the attainment measures (including the TCP) and interim measures should be finalized and submitted to EPA in June 1975. The task descriptions, agency responsibilities, and funding requirements for the long-term comprehensive plan development should also be submitted to EPA in June 1975. In addition interagency memoranda of understanding should be obtained stating the agency responsibility in plan development and agreements to persuade new industry with significant TSP or SO_2 emissions to avoid the "hot-spot" areas. Any transportation system improvements or review procedures, mobile source controls, or indirect source control programs that are required for attainment or maintenance should be delineated and presented in the transportation control plan or the maintenance plan submitted in June 1975.

Phase 2 consists of the selection and development of the long-term comprehensive approach: the implementation of all attainment measures, TCP measures, transportation policies or measures required for maintenance, interim source control measures required for maintenance, and voluntary compliance with the "hot-spot" land use policy. If voluntary compliance with the "hot-spot" policy is not effective, the Missouri Air Conservation Commission "hot-spot" regulation can be strictly enforced for existing sources. Any SIP revisions can also be completed during this time period.

By 1980, it is expected that all administrative programs, legal authority, and monitoring and surveillance requirements of the comprehensive long-term plan can be implemented. The AQMP development can then become a five-year review and revision cycle, as proposed in the EPA Guidelines.

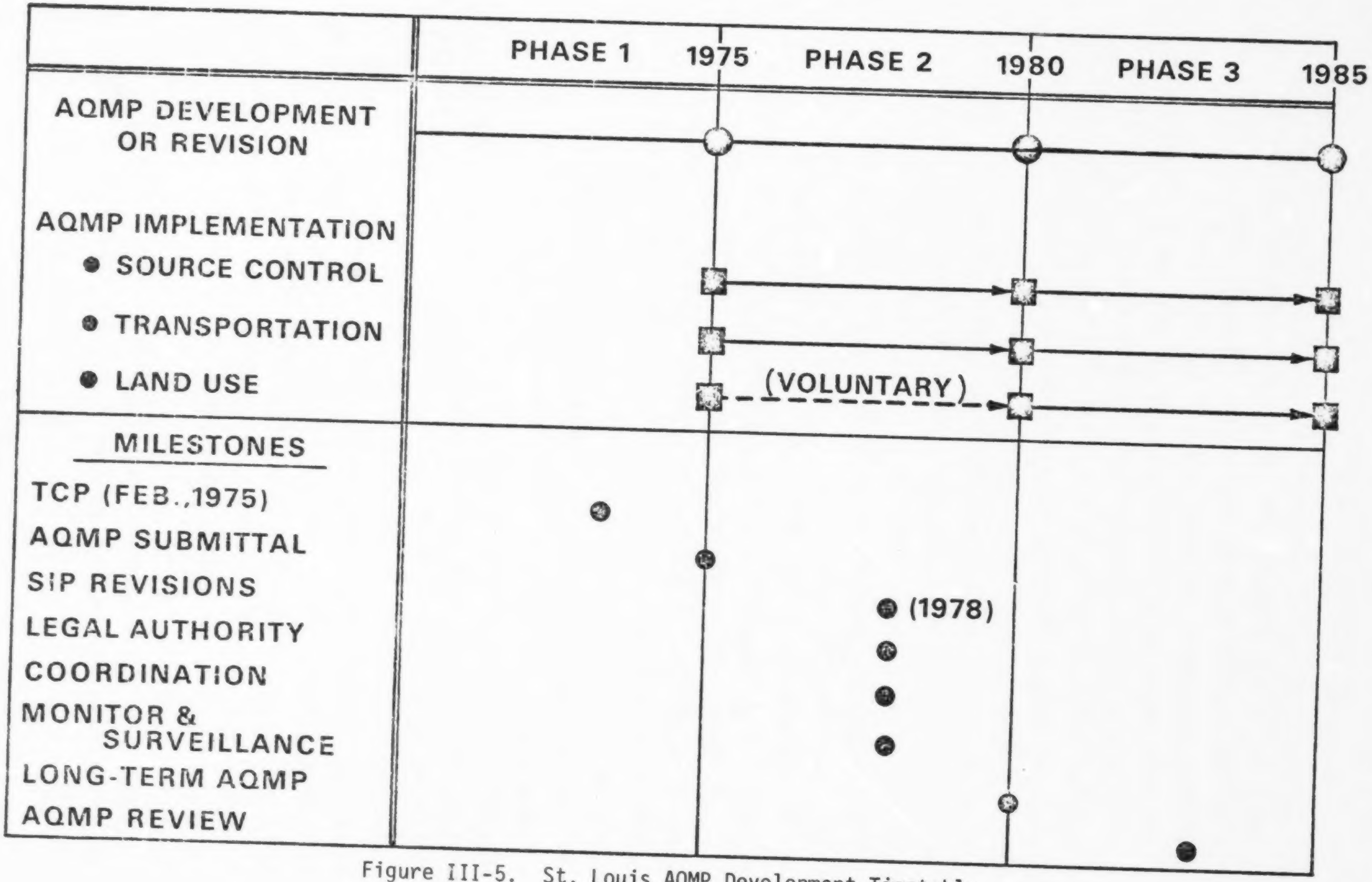


Figure III-5. St. Louis AQMP Development Timetable.

VIII. Legal Authority

The enabling legislation given in the State Implementation Plans is sufficient basis for the implementation of all source control measures required for attainment and maintenance of the standards.

The long-term comprehensive approaches to air quality maintenance described in Chapter IV are administrative approaches. They maintain air quality indirectly by the application of land use and transportation policies that tend to minimize emission, especially in the "hot-spot" areas. Specific land use control regulations may be adopted to formalize these policies. For example, emissions allocation can be implemented as a regulation calling for a ceiling on emissions within each small community or geographic area within the AQMSA.

The following paragraphs describe existing legislation directly related to air quality maintenance.

The Air Quality Implementation Plans and related regulations as adopted by Missouri and Illinois form the enabling legislation for the St. Louis AQMSA. Attainment of the standards will rely on implementation and enforcement of these regulations. Any regulations adopted as a result of the Transportation Control Plan currently being prepared will become part of this body of regulations.

Two regulations included in the Missouri SIP are particularly applicable to the maintenance of air quality once the standards are attained. These regulations are summarized briefly below.

Regulation XVIII. Approval of Planned Installations, Land Use Plans, and Zoning Regulations Required. This regulation is the basis for the permit system for new sources. Paragraph B of this regulation requires the executive secretary of the MACC to review all land-use plans prior to formal adoption by local areas and prepare recommendations according to the regulations. No local plan may be adopted without the approval of the executive secretary. Paragraph C places similar requirements on the review and approval of zoning agency regulations and proposed changes in zoning classifications.

This regulation is not currently implemented in the AQMSA and because no penalties are stated for non-compliance, the agency has no enforcement authority. However, it could serve as the basis for monitoring all planned community growth and development.

Regulation XXIII. Additional Air Quality Control Measures May Be Required When Sources Are Clustered in a Small Land Area. This regulation applies to particulate and SO_2 emission sources in areas that exceed a given allowable emission density. The MACC may prescribe more restrictive requirements in such areas than are provided in the regulations of general applicability.

This may be referred to as a "hot-spot" regulation. It provides for more restrictive controls where source clustering may cause the standards to be exceeded although all emissions limitations are being met. This regulation is not currently being implemented because many compliance schedule deadlines have not been reached. However this regulation could be applied to maintain emission density levels below that level at which ambient pollutant concentrations are estimated to exceed the standards for particulates and sulfur dioxide. This would require an accurate estimate of the relation between emission density and ambient concentration in a given area. This relationship may vary due to the relative source-receptor characteristics of an area. The RAPS program should provide sufficient data for this determination. Short-term emissions limitations would be the most difficult to establish.

SUMMARY OF ST. LOUIS AQMSA

POLLUTANT: TSP[*]

NAAQ STANDARD: 60 $\mu g/m^3$ (annual secondary standard); 75 $\mu g/m^3$ (annual)

CURRENT AIR QUALITY, 1971: 135.0 $\mu g/m^3$ (annual)[†]

EXPECTED AIR QUALITY IN 1975: 120 $\mu g/m^3$ (annual, projected)

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD: 63% (by rollback)

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

1. SIP Regulation Enforcement, Extended Monitoring - June 1975
2. "Hot-spot" Regulation - June 1976
3. Long-Term Comprehensive Approach - June 1980

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED:

New Federal programs for particulate control must be coordinated, including: new source performance standards, fine particulate regulations, and significant deterioration. Long-term coordination with regional planning to avoid "hot-spots".

---

[*] Background of 40 $\mu g/m^3$ assumed.

[†] Broadway and Hurek, St. Louis City

SUMMARY OF ST. LOUIS AQMSA

POLLUTANT: CO

NAAQ STANDARD: 9 ppm (2nd highest - 8 hr.)

CURRENT AIR QUALITY, 1972: 16.8 ppm (2nd highest - 8 hr.)

EXPECTED AIR QUALITY IN 1977*: 7.6 ppm (APRAC-1A projection)

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD: 46% (rollback)

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

1. Transportation Control Plan - June 1975
2. Indirect Source Review - June 1975
   Exclusive Bus/Carpool Lanes - June 1975
3. Comprehensive Transportation Planning (in effect) - June 1980

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED:

Coordination of FHWA, EPA, State Highway Departments, local street planning, the 3-C planning agency, the indirect source review agency, and the air pollution control agencies. The TCP Advisory Committee can provide initial guidance.

---

*With proposed TCP Strategy III as in PEDCo Attainment Study.

SUMMARY OF ST. LOUIS AQMSA

POLLUTANT: SO_x

NAAQ STANDARD: 80 μg/m^3 (annual); 365 μg/m^3 (2nd high - 24 hr.)

CURRENT AIR QUALITY, 1972*: 557 μg/m^3 (max. 2nd highest - 24 hr.)

EXPECTED AIR QUALITY IN 1975: 322 μg/m^3 (24 hr., projected at one source)

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD: 34% (rollback)

PROPOSED ATTAIN/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

1. Enforcement of SIP Controls - June 1975
   Expanded Monitoring (RAPS)
2. "Hot-Spot" Regulation - June 1976
3. Interim Source Controls - June 1975
   SO_2 Reduction at Power Plants
   Municipal Refuse in Power Plants
4. Long-term Comprehensive Planning - June 1980

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED:

Coordination between EPA and the Federal Power Commission, utility companies, air pollution agencies. Coordination with energy conservation programs. Long-term coordination with regional planning to avoid "hot-spots".

---

*Illinois data, Missouri at standards.

SUMMARY OF ST. LOUIS AQMSA

POLLUTANT: HC/Photochemical Oxidants

NAAQ STANDARD: 160 $\mu g/m^3$ (peak--one hour)

CURRENT AIR QUALITY, 1972: 300 $\mu g/m^3$ (2nd highest peak-hour)

EXPECTED AIR QUALITY IN 1975: (75) 240 $\mu g/m^3$ (Max - hr., Appendix J)

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD: 47% (Appendix J)

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

*1. Transportation Control Plan - June 1975
2. Additional stationary source HC control - June 1976
3. Comprehensive Transportation Planning (in effect) - June 1980

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED:

Coordination of FHWA, EPA, State Highway Departments, local planning, air pollution control agencies for mobile source control as in the CO control. Negotiation between EPA, state air agencies and individual source for compliance schedule changes as stationary point sources.

---

*Additional stationary source control may be required. June 1975.

Chapter IV

BALTIMORE TRIAL AIR QUALITY MAINTENANCE PLAN*

I. Characteristics of the Baltimore AQMSA

The Baltimore Air Quality Control Region boundaries conform to the Baltimore Standard Metropolitan Statistical Area and encompasses 2,364 square miles (Figure 1). Included in the region are the City of Baltimore and the counties of Anne Arundel, Baltimore, Carroll, Harford, and Howard. The Region forms the western edge of the northern section of Chesapeake Bay. The western portion of the Region lies in the Piedmont Plateau, while the eastern portion lies within the Middle Atlantic Coastal Plain. The eastern portion is generally flat, with elevations of less than 500 feet. Toward the west, the elevation rises gradually to the gently rolling areas of Carroll and Howard Counties where elevations reach 1,000 feet. The topography generally permits free air movement with little channeling effect.

Population of the Region increased 19 percent between 1960 and 1970 to a total of nearly 2.1 million. The 1970 census data indicate that projected growth patterns and population estimates were reasonably accurate except for the City of Baltimore, which was estimated to have lost approximately four percent in population. The population of Baltimore County increased over 26 percent in the same 10-year period and ranked as the most populous county in the State.

Weather Bureau data indicate that inversion conditions occur on short term basis about 34 percent of the time in the Region. Over a thirty-year interval, the Region averaged 1.5 times per year when stagnation occurred that averaged 4.3 days duration. During the same thirty-year period, the region experienced three cases of stagnation that lasted for seven or more days.

The time frame in which air quality maintenance plans were considered to be applicable was 1975 to 1985.

Four pollutants were considered for analysis (i.e., particulate matter, sulfur dioxide, photochemical oxidant (hydrocarbons) and nitrogen dioxide. Carbon

---

*Development of a Trial Air Quality Maintenance Plan Using the Baltimore Air Quality Control Region, NTIS No. PB 416/AS

Preceding page blank

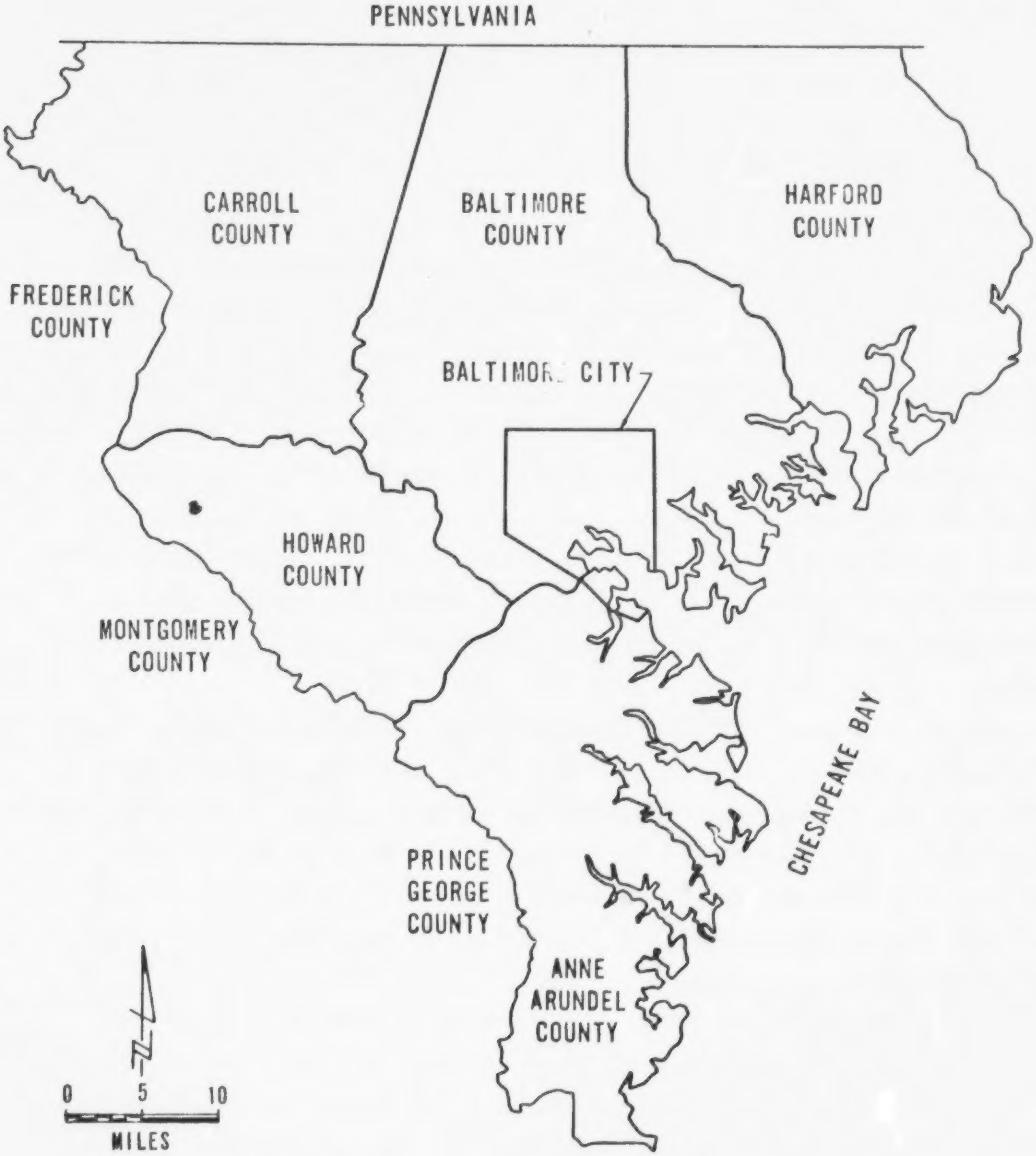

PENNSYLVANIA
CARROLL COUNTY
BALTIMORE COUNTY
HARFORD COUNTY
FREDERICK COUNTY
BALTIMORE CITY
HOWARD COUNTY
MONTGOMERY COUNTY
CHESAPEAKE BAY
PRINCE GEORGE COUNTY
ANNE ARUNDEL COUNTY
N
0
5
10
MILES

Figure IV-1. Baltimore air quality control region

monoxide was not included in the sample plan. A preliminary analysis based on existing air quality and emission inventory data indicated that the future carbon monoxide levels would not exceed the standards and therefore should not be considered in the maintenance program.

The sample air quality maintenance plan was developed so that the National Secondary Ambient Air Quality Standards would be achieved and maintained. The analyses did not attempt to develop plans for achieving or maintaining the more stringent ambient air quality standards of the State of Maryland.

To initiate analyses of the need for air quality maintenance plans, consideration was given to the existing air quality, existing emission inventory, and existing regulations and compliance schedules for reducing various pollutant sources. Maintenance plans were conceptually designed to offset increases in projected emissions as a result of growth through enactment of increasingly stringent control measures (Figure 2). It is therefore assumed that existing regulations would be complied with by 1975 or 1977. However, it was recognized that, in certain cases, the National Secondary Ambient Air Quality Standards would not be met by the 1974 or 1977 date. In such cases, maintenance strategies theoretically could be selected that would more than compensate for the anticipated growth in emissions. The selected control measures would thereby offer the possibility of eventually replacing currently unacceptable control measures such as gas rationing. During preparation of the sample plan, Congress extended the date for additional motor vehicle emission controls to 1977 and limited application of certain measures that had earlier been advocated as hydrocarbon control (VMT) measures; for this analysis, the assumption was made that by the year 1985 motor vehicles would be tightly controlled.

Control measures considered for implementation were reviewed and evaluated by the Baltimore Regional Planning Council's Air Quality Task Force. The background and experience of the Task Force offered a broad-based and wide-ranging viewpoint from State and local officials toward the air quality planning as a part of other and broader long range plans for the Region. Similar groups should be of value in development of other AQMPs.

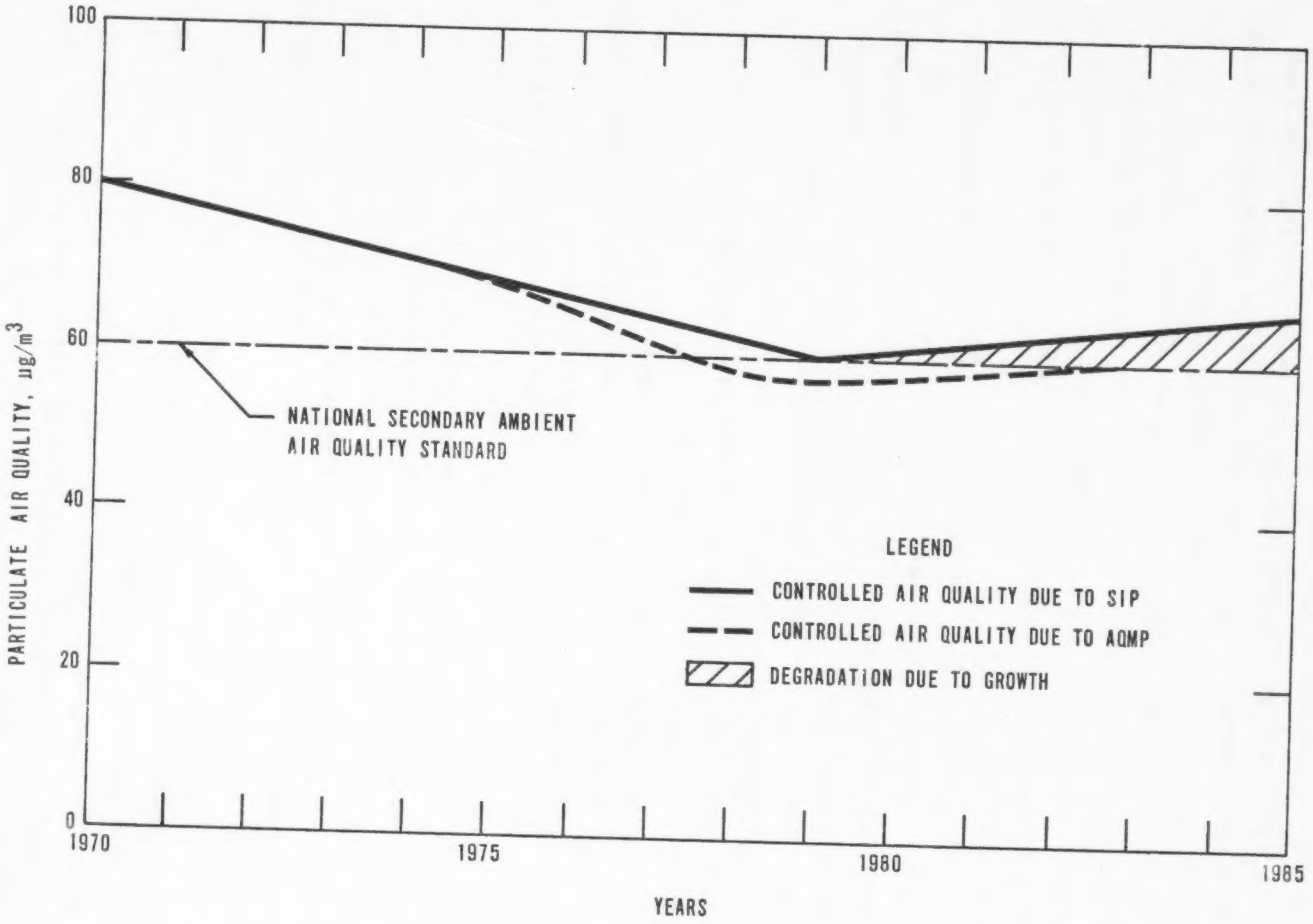


Figure IV-2. Projected effectiveness of SIP and AQMP

II. Intergovernmental Cooperation

A. List of Agencies, Governments and Groups Contacted in Preparing and Implementing AQMP

1. State

a. Maryland Department of Health and Mental Hygiene, Bureau of Air Quality Control;

b. Maryland Department of Transportation, Division of Systems Planning and Development;

c. Maryland Department of State Planning, Office of Regional and Local Planning--Baltimore Area; Office of Comprehensive State Planning--Natural Resources.

d. Office of Maryland State Attorney General.

2. Regional

Baltimore Regional Planning Council
- A-95 Review
- HUD 701 Planning Programs
- 3-C Planning Programs
- Land Use and Recreation Department
- Transportation Department
- Air Quality Task Force

3. Local

a. City of Baltimore
- Mayor's Office [1/]
- Department of City Planning
- City Health Department [1/]
- Interstate Division for Baltimore City (Joint City/State)

b. Anne Arundel County
- Department of Planning
- Citizen Representative [1/]

c. Baltimore County
- County Development Coordinator [1/]
- Department of Planning

[1/] Indicates that contacts were made primarily or solely through the Air Quality Task Force of Baltimore Regional Planning Council.

d. Carroll County
  Citizen Representative [1]
  County Health Department [1]
  Department of Planning

e. Harford County
  County Planning and Zoning Commission [1]

f. Howard County
  Department of Planning
  Citizen Representative [1]

g. City of Annapolis
  Director, Planning and Development [1]

4. Other

  a. Baltimore City Medical Society [1]
  b. Better Air Coalition [1]
  c. American Lung Association of Maryland [1]
  d. Baltimore Gas and Electric Company

B. Responsibilities of Agencies, Groups and Governments to AQMP Agency

The agency to be assigned responsibility for the preparation of the AQMP is the Maryland Department of Health and Mental Hygiene, Bureau of Air Quality Control (BAQC).

1. Planning Activities

  a. Provide Land Use Plans

Baltimore Regional Planning Council (RPC), Land Use and Recreational Department [2]

City and County planning agencies, as necessary, to amplify and up-date RPC plans.

  b. Provide Transportation Plans

Department of Transportation - Division of Systems Planning and Planning [2] will be prime source of data, of interpretation and of technical assistance in the plan

Baltimore RPC, Transportation Department, who have worked closely on transportation plans with Maryland DOT

---

[1] Indicates that contacts were made primarily or solely through the Air Quality Task Force of the Baltimore Regional Planning Council.

[2] Indicates prime source(s) of data and assistance throughout this section of the Digest.

BAQC has worked extensively with the data and will have much of it available in-house.

c. Provide Housing Plans

Baltimore RPC, Housing Department [2/]

City and County planning agencies will provide details and up-date of the data as necessary.

d. Provide Redevelopment Plans

Baltimore RPC [2/] will have most of the data

City of Baltimore, Department of City Planning [2/] will be the source of detailed plans for the City as these are necessary.

County planning agencies for other redevelopment, both public and private, where additional detail beyond that available from RPC is required.

e. Provide Health Plans

Maryland Department of Health and Mental Hygiene

Baltimore RPC will have local, current, detailed, knowledge of facility construction plans through their review process.

f. Provide Open Space/Recreation Plans

Baltimore RPC, Land Use and Recreation Department [2/] have complete and detailed data on all types of recreation and open space probram.

Maryland Department of State Planning can provide more detailed data on specific state recreational facilities.

g. Provide Capital Improvement Programs

Baltimore RPC will provide bulk of data

Baltimore City and County agencies may be called on for additional details and assistance as necessary.

h. Participate in A-95 Review Process

Baltimore RPC is the accredited review agency and would cooperate with the AQMP agency at planning and implementation phases.

i. Review EIS

Not applicable in planning stage since no EIS prepared.

[2/] Indicates prime source(s) of data and assistance throughout this section of the Digest.

j. Prepare EIS

The sponsoring agency must prepare the EIS for defined Federal actions, but at the planning stage of the procedures, there is no EIS prepared.

k. Provide Growth Projections

Baltimore RPC (Systems Analysis and Data Services) can provide the basic sets of growth projections on which most of the transportation-land use and public facility planning in the region is predicated. These may be taken as approved by the local communities since the General Development Plan has been adopted.

Study team went through process of growth reallocation in the analysis of the effects of land use strategies in maintenance of air quality standards.

l. Review Growth Projections

Other agencies have developed differing projections or may regard existing projections dates as a result of rapid recent changes in social and demographic indices. Department of State Planning should review RPC's projections.

m. Provide Emission Factors

Bureau of Air Quality Control, the AQMA planning agency, should have access to this data from their own records.

Utility company will provide supplementary data on policy regarding future distribution of home heating units between oil, gas and electricity and on the future availability of fuels to be used in local generating plants.

Federal EPA publications.

n. Review Emissions Factors

BAQC will do in final plan.

o. Provide Emissions Projections

BAQC will do in final plan.

p. Review Emissions Projections

BAQC will do in final plan.

q. Other

none.

2. Implementation Activities

The activities described include all of those considered and discussed in the planning program and not only those actually incorporated into the selected plan. The manner in which responsibilities for implementation may be assigned are specified in a. to g. below.

a. Zoning

City of Baltimore. Most of the "hotspots" for TSP concentrations, to which zoning regulations would be applied, are in the City.

Adjacent counties would be called on to amend their zoning ordinances and zoning plans to exclude certain uses and promote desired development patterns.

This category of implementation measure includes:

Special Use Zone
Floating Zone
Large Lot Zoning
Agricultural and Conservation Zoning
Holding Zones
Planned Unit Development
Performance Standard Zoning
Emission Density Zoning

b. Permits

The use of permits would be applied as an operating procedure to many of the types of control measures discussed in this section.

c. Utility Extension

The provision of water and sewer services as a means of controlling growth would lie with the municipalities (cities and counties), though RPC would be the means of developing the overall policy and plans under which the separate municipal utility construction programs would proceed.

d. Subdivision Regulations

These local controls affecting, for example, permitted densities anf regulation of paved sections, would be the responsibility of the local governments.

e. Building Codes

These local controls specifying construction techniques, materials and standards, including heating and insulation specifications are the responsibility of individual cities and counties. The State could play a major role in the promulgation of a State model code incorporating required changes assigned to improve air quality.

f. Housing Codes

These controls, applying to all residential structures and specifying standards to insure adequacy of light, heat, air and ventilation, are the responsibility of the cities and counties. Again, the State could assist by promulgating a model code sensitive to air quality considerations.

g. Emission Density Zoning

This is covered in Paragraph a. Zoning above.

h. Stationary Air Pollution Control

The Bureau of Air Quality Control has full authority to control emissions from existing sources, to control the introduction of new sources (other than power plants) and to control changes in industrial processes and materials that result in changes in emissions. This agency, also the AQMP Planning Agency, should retain these responsibilities.

i. Performance Standard Zoning

This is included under Paragraph a. Zoning above.

j. Control Travel

The selective banning of trucks and of automobiles in specified areas would be undertaken by cities and counties in conformance with detailed plans prepared under the auspices of RPC.

The restriction of total number of aircraft operations out of Baltimore-Washington International Airport would be the responsibility of the operators, Maryland DOT, State Aviation Administration.

k. Taxes

Taxation policies to control land development on the urban fringe would be the responsibility of localities within legislative limits established by Maryland State Legislature.

Differential rates of sales tax on larger automobiles as a means of encouraging use of smaller vehicles would require authorization by

State and administered by the Maryland Department of Taxation and Revenue.

The imposition of increased levies on automobile ownership would be achieved through local annual taxes on property.

l. Vehicle Emission Controls

Requirements for fitting emission control devices to heavy duty vehicles could be either a Federal or State action. State action is recommended since this is easier to achieve expeditiously.

m. Reviews

Review of public actions under Section 109 (J) of the Federal Highway Act and under A-95 review procedures would lie with RPC.

n. Other Development Controls

Development districts and transfer of development rights are measures that would be exercised by local governments within a framework for action prepared under the auspices of RPC.

o. Urban Renewal

This measure must be initiated by local governments, primarily the City governments, with support from State and Federal agencies.

p. Public Participation

The Air Quality Task Force of RPC, suitably broadened, restructured and with a redefinition of its mission would be the means by which public participation in the implementation of the plan would be achieved.

C. Basis for Assignment of Responsibilities

1. Zoning

The local governmental units have the legal authority and the technical capacity to perform. Any other assignment of responsibility would be politically unacceptable, calling for major redelegation of police powers by the State of Maryland.

The task will be satisfactorily performed if the local units of government will participate in the regional AQM planning procedures and their elected officials are able to justify the actions to City and County residents.

2. Permits

This is not considered a separate measure, but would be applied as an operating procedure to many of the types of control discussed here. However, the fact must be recorded that any extension in applications, permits and approvals required to run a business, develop land or operate motor vehicles will be unpalatable to the public and will be resisted.

Permit systems will be required, but their success will depend on keeping them simple, speedy, reduced to a minimum and easily understood by the public.

3. Utility Extension

Current authority is vested in water and sewer authorities or in Public Works Departments of city and county governments, but the management structure is in both cases local. Any manipulation of these elements as part of the AQM would therefore be effected through these agencies.

New measures would be effective provided that they are not extreme to the point of challenge on the grounds of legality.

4. Subdivision Regulations

The local planning agencies and their appointed boards and commissions already have the legal authority and administrative machinery to implement these measures and they are best qualified to retain this responsibility.

The revised regulations to improve air quality will more readily be implementable in the Baltimore AQMA if they are applied to the State as a whole; development of State model regulations would facilitate implementation.

5. Building Codes

The local building inspectors administer the existing codes after adoption by City Council or county council or commissioners. They have the legal authority and the administrative machinery to administer revised codes and are best qualified to retain this responsibility.

The revised codes will be more readily implementable in the Baltimore Region if they are applied to the State as a whole; development of State model codes would facilitate implementation.

6. Emission Density Zoning

This is covered in Paragraph 1. Zoning above.

7. Stationary Air Pollution Source Control

The BAQC of Maryland State Department of Health and Mental Hygiene has the legal authority and the administrative machinery to set standards, monitor and control emissions and the responsibility should remain with this agency.

The agency has ample authority to be effective and will retain this authority given community and political support

8. Performance Standard Zoning

This is covered in Paragraph 1. Zoning above.

9. Control of Travel

The RPC is the proper forum for planning and public discussion of the details of a regional plan for selective regulation of truck and automobile travel. It has no legal authority but it can provide a good forum for discussion and agreement between local and regional interests.

The controls would be imposed by local government on City and county streets. This is where the legal authority currently lies.

Authority to restrict or regulate aircraft operations lies with the operator of Baltimore-Washington International Airport, the State Aviation Administration of Maryland DOT. No shift in this responsibility should be considered. The feasibility of appropriate changes in operations would hinge on two factors, the ability of the airlines to substitute larger aircraft for smaller aircraft and Federal policy regarding distribution of aircraft operations between the three Washington metropolitan airline airports.

10. Taxes

Responsibility for the land taxes discussed in the plan lies with local governments. The development changes to which tax revisions are directed must be determined and approved by local governments and it is proper that the implementative machinery also remain with local government, through their taxation and assessor's offices.

11. Vehicle Emissions Controls

The measure will be partially effective in the Baltimore Region if it is implemented at State level, and fully effective if it is imposed as a Federal requirement. The authority of both Federal and State governments to impose such requirements exists. State regulation is recommended on the grounds that this may be more easy to achieve.

12. Reviews

These are established procedures by the Federally designated agency (RPC) and should not be changed.

13. Other Development Controls

Development districts and transfer of development rights lie in areas of responsibility delegated to local governments by the State of Maryland. There is no advantage to re-assigning those responsibilities.

14. Urban Renewal

Urban renewal is a function delegated to local government and no advantage is seen in re-assigning these responsibilities.

This measure will be effective only if the major funding programs of Federal and (to a lesser extent) State governments are continued.

15. Public Participation

RPC is already the primary forum for discussion and resolution of regional problems and issues; its nature permits these discussions to take place in a comprehensive context; lines of communication are already very well established; RPC already has an action Air Quality Task Force. In all respects, it is the appropriate level and agency to handle public input and discussion of implementation, in conjunction with the AQMA Planning Agency.

D. Organizational Relationships To Maintain Coordination

1. Organization Relationships Utilized in Preparation of Sample Plan

a. Technical Agencies

The principal technical agencies involved in preparing the AQMA sample plan were:

Regional Planning Council
Maryland Department of Health and Mental Hygiene,
    Bureau of Air Quality Control
Maryland Department of Transportation
    Division of Systems Planning and Development
City of Baltimore
    Department of City Planning
    Interstate Division for Baltimore City

These agencies provided data and references and reviewed study progress and findings on a continuing basis through the study procedures.

b. Air Quality Task Force of RPC

This is a joint technical-citizen advisory group established by RPC, prior to commencement of the AQMP activity, with membership from disparate agencies, interests and local units of government from the Baltimore Region.

It provides an excellent forum for discussion of plan elements with industry, government and citizen groups, for the resolution of problems and for testing public acceptability of various maintenance measures. However, the level of coordination between counties required for the plan preparation was not possible through this Task Force since not all counties were represented at all meetings, and representatives had no authority to speak for or commit their counties to a line of action.

c. Existing Institutional Relationships

Refer to Figure 3 showing existing relationships.

d. Pertinent Aspects of Existing Institutional Relationships

The AQ Task Force includes representation from all listed principal technical agencies, including BAQC.

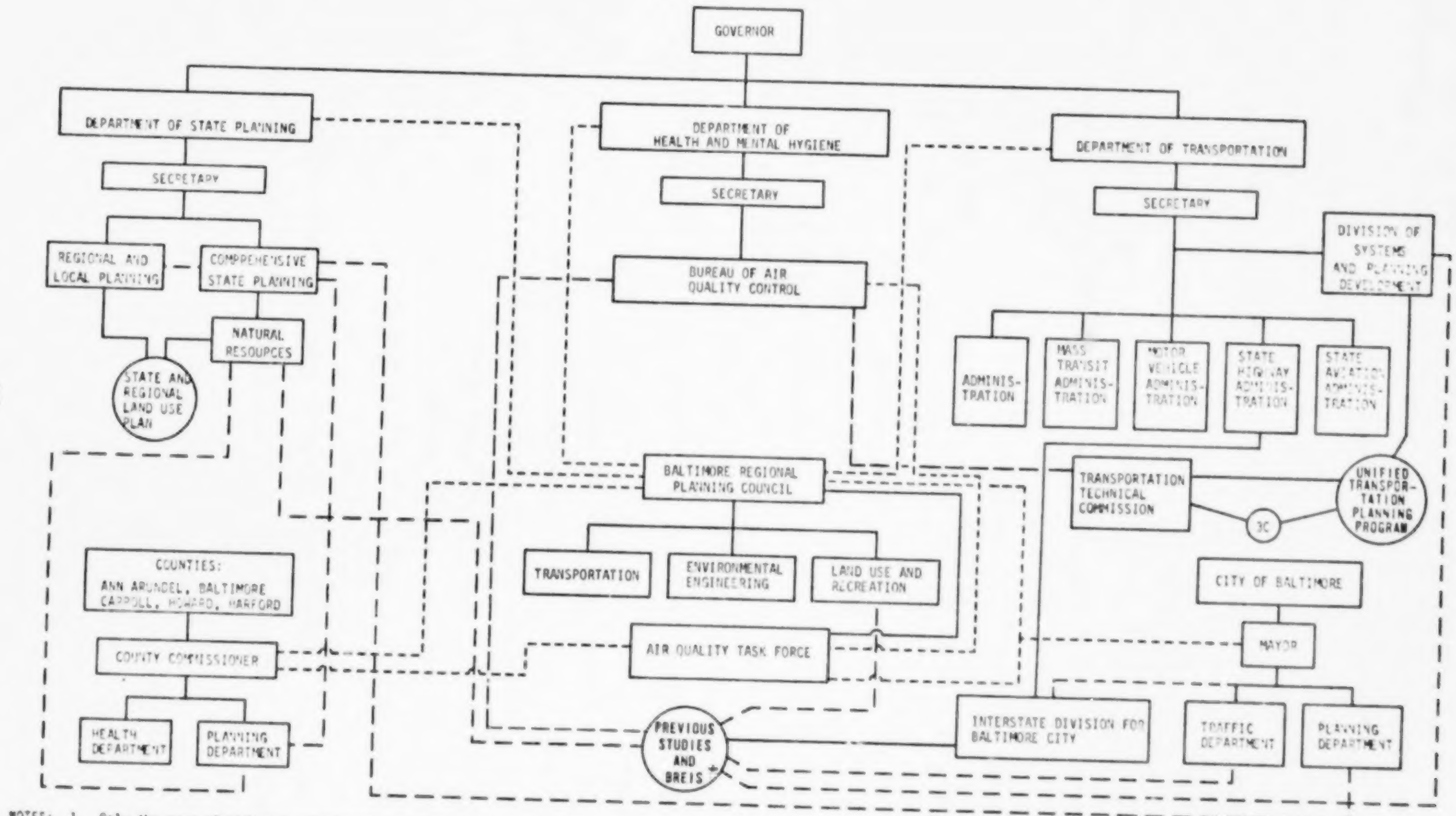
The AQ Task Force includes representation from all jurisdictions in the region.

The AQ Task Force is organized as an advisory body to the RPC, the agency with responsibility for comprehensive planning inclusive of land use, transportation and public facility planning and for coordination of the activities of the constituent local governments in the region. A direct conduit between the Task Force and RPC assumes that RPC's activities will be sensitive to air quality concerns and to the proceedings of the Task Force.

The chart does not reflect on-going contacts and cooperation between BAQC and virtually all of the technical agencies represented on the chart.

The chart does not show BAQC participation in the major studies.

Figure IV-3. **Existing institutional relationships - Baltimore air quality maintenance planning**


GOVERNOR
DEPARTMENT OF STATE PLANNING
SECRETARY
REGIONAL AND LOCAL PLANNING
COMPREHENSIVE STATE PLANNING
NATURAL RESOURCES
STATE AND REGIONAL LAND USE PLAN
DEPARTMENT OF HEALTH AND MENTAL HYGIENE
SECRETARY
BUREAU OF AIR QUALITY CONTROL
DEPARTMENT OF TRANSPORTATION
SECRETARY
DIVISION OF SYSTEMS AND PLANNING DEVELOPMENT
ADMINISTRATION
MASS TRANSIT ADMINISTRATION
MOTOR VEHICLE ADMINISTRATION
STATE HIGHWAY ADMINISTRATION
STATE AVIATION ADMINISTRATION
BALTIMORE REGIONAL PLANNING COUNCIL
TRANSPORTATION
ENVIRONMENTAL ENGINEERING
LAND USE AND RECREATION
AIR QUALITY TASK FORCE
TRANSPORTATION TECHNICAL COMMISSION
3C
UNIFIED TRANSPORTATION PLANNING PROGRAM
CITY OF BALTIMORE
MAYOR
INTERSTATE DIVISION FOR BALTIMORE CITY
TRAFFIC DEPARTMENT
PLANNING DEPARTMENT
COUNTIES: ANN ARUNDEL, BALTIMORE CARROLL, HOWARD, HARFORD
COUNTY COMMISSIONER
HEALTH DEPARTMENT
PLANNING DEPARTMENT
PREVIOUS STUDIES AND BREIS*

NOTES: 1. Only the more significant relationships are shown.

2. Only relationships relevant to the air quality planning process are shown.

3. The importance of RPC and the central function of the Air Quality Task Force is demonstrated.

— LINES OF AUTHORITY
▭ AGENCY
○ STUDY AND PLANNING PROGRAM
---- MEMBERSHIP
— — LIAISON

*Baltimore Regional Environmental Impact Study

2. Problems Encountered in Preparation of the Trial Plan

a. Coordination

Few problems. The cooperation of agencies was outstanding and the existence of the AQ Task Force provided readymade machinery for public input and coordination meetings.

b. Other

Time to complete the project.

3. Changes in Institutional Arrangements Recommended for Preparation

a. The AQ task force be assigned additional responsibility for advice to BAQC in its planning program, sponsoring public meetings at appropriate stages of the program and serving as the channel for communication with the community through the study period.

b. If it is to serve this purpose, some enhancement of its membership may be required, together with additional staff support from RPC.

III. Baseline Emissions Inventory

A. Baseline Year

1972 was the latest year for which a complete hydrocarbon and NO_x emission inventory was available along with the required air quality data. Furthermore, this was the baseline year for the EPA Transportation Control Plan (TCP).

For particulates and sulfur dioxide, 1972 area source data and 1973 point source data were used. It may have been preferable to use the 1970 inventory, which would have been compatible with the SIP but such data were not available.

B. Source of Emissions Data

All emission data were obtained from the Maryland BAQC, which was the source for the TCP. The BAQC VMT data were obtained from a modification of the regional planning council transportation study.

BAQC emission data were used in preference to NEDS data since comparison showed the Maryland data to be more complete (NEDS files are being updated by BAQC).

The BAQC transcribes pertinent information from their permit applications onto computer tape, generating a file that identifies all sources of emissions in the entire state. An extract of this file for the AQMA was obtained from the BAQC along with the appropriate file/field identifications. There were over 10,000 point and area sources included in Baltimore AQCR so relevant data were summarized. Certain criteria were used in making the summaries. For example, not all of the 9,000 point sources could be included in the dispersion models. For particulate matter, 100 point sources with greater than 25 tons/year of emissions were used. Area sources were delineated on the tape as discrete categories such as domestic, commercial, vehicles, etc.

C. Geographic Location of Sources

All sources in the AQMA were considered without regard to location for HC/O_x relationship and projections. The same applied for nitrogen dioxide.

For particulates and sulfur dioxide, all point and area sources were located. The magnetic tape obtained from the BAQC identified horizontal and vertical coordinates of each stack.

D. Technical Assumptions about Existing and Future Emissions Source Controls

All EPA regulations imposed by the TCP were assumed to be enforced except gas rationing and LDV retrofit. In addition, a state regulation prohibiting any new source of 100 tons/year or greater of any pollutant, or any increase of all sources by the same amount was considered to be effective.

In determining projected emissions for 1975 and 1985, all emissions regulations were considered effective. This involved the use of EPA regulations for automobiles, state regulations for particulates and sulfur dioxide, and local regulations predominantly for sulfur in fuel limits. The state regulations that were used were those in effect during the course of the study that would regulate the amount of the emissions from each source category.

E. Technical Assumptions about Emission Factors

EPA emission factors made available for this evaluation were used.

F. Problems and Suggested Solutions and Recommendations

The problem of reconciliation of the hydrocarbon inventory among the interested participants was of some significance in this investigation.

In the development of AQMPs early meetings should be held to discuss differences and reach concensus.

IV. Emission Projections

Methodology similar to that described in EPA guideline documents was used for projecting emissions from one base period to some future period.

A. Methodology

Planning data from the Regional Development Plan were incorporated into this study. In general, the following factors were used for direct proportioning of data of the base period year to some future period:

power plants - FPC projected capabilities which were available until 1983
industrial processes - manufacturing employment (intensive)
fuel combustion/residential heating - number of dwelling units
fuel combustion/commercial and institutional - employment (intensive)
refuse disposal - population increase
transportation (cars, trucks) - vehicle miles travelled

The planning data from the RPD were delineated by regional planning districts. ES converted the projections for the RPD areas to coincide with the Maryland BAQC grid system. Since the emission inventory was available for grid system, the land use planning projections had to be made to 'fit' the existing data base for area emissions.

Changes in vehicle miles travelled were based on data from the MDOT. These data were stratified by RPD and were based on the General Development Plan highway and transit systems with no controls or policy changes in effect. The MDOT projections of VMT were derived from the Baltimore Regional Environmental Impact Study (BRIES). This study developed models for trip generators, mode choice, and traffic assignment based on the RPC land use model forecasts. Among the outputs of the models were VMT for each RPD stratified by highway type and by level of congestion for 1980 and 1995. Linear interpolation was used to obtain projected values for 1977, 1980, and 1985.

Specifically for the projections of hydrocarbons the following assumptions were used:

- Gasoline storage and handling growth rates were projected at one half the growth rate of VMT (in thousands of miles).

VMT 1977 = 3,255.90
Growth Rate = 3.62 percent per year
VMT 1980 = 3,622.04
Growth Rate = 1.72 percent per year
VMT 1985 = 3,943.65

This projection assumed the continuation of the present trend toward smaller cars and increased gasoline mileage.

- Power plant emissions would decrease because of the decrease in generating capacity within the AQMA.
- No change was projected in hydrocarbon emissions from refuse disposal because of the ban on open burning and control of incinerators.
- Diesel and shipping included, for 1977, 0.28 tons per peak period for diesel highway vehicles and 0.92 for other diesel sources. Diesel highway vehicles and 0.92 for other diesel sources. Diesel highway vehicle emissions were projected at 1.1 times the growth rate in VMT to reflect increased city bus service. Other sources were projected at the growth rate of transportation employment, 1.2 percent per year.
- Growth in industrial process heating was based on growth of manufacturing employment, 0.5 percent per year.
- A reduction in dry cleaning establishment emissions resulted from the regulation prohibiting the use of reactive solvents.
- Emissions from other solvent uses were projected on the basis of growth in manufacturing employment.
- Miscellaneous gasoline engines were projected to grow at the same rate as population, 1.52 percent per year.
- Aircraft operations would grow at a rate of 7.7 percent per year.
- VMT growth factors were obtained from transportation data provided by the Maryland Department of Transportation (from BRIES).

B. Problems and Suggested Solutions

One of the fundamental problems in estimating future air quality based on economic and land use projections is the assumed geographic location of the new sources. In Baltimore a large quantity of particulate emissions are generated from large industrial operations like the Sparrows Point Plant of the Bethlehem Steel Corp. It is unlikely that a two-fold increase in intensive employment at the Sparrows Point RPD could result in a corresponding two-fold increase in particulate emissions from the steel plant. Although growth is anticipated at the Sparrows Point Plant, the employment will likely occur in nonpolluting sources that augment the basic steel manufacturing processes. It is suggested that for those areas of the country where one single plant influences the air quality, that these large industrial sources should be treated separately, perhaps as power plants are in the fuel combustion category. Another significant problem encountered in projecting air quality for particulates was the handling of a large number of small sources in dispersion models. One future procedure might involve the smearing of the small point sources among the various grids (area sources) used in the study. Of course, this would require assumption of the release height. Area sources for example were assumed to have an emission release height of 10 meters. When combining these less than 25 ton per year point sources and calling these area sources, a stack height of perhaps 25 meters should be incorporated. The effect of including all, instead of one-third of the emissions as was done in this trial plan, will be a better resolution in terms of calibration of the dispersion models.

C. Recommendations

The methodology described in the guideline documents seems strictly applicable to area type emission sources. Marginal errors are likely when projecting point source emissions from one base period year to a future period. Instead of basing the point source emissions on various economic and land use planning parameters, it is suggested that a statistical sampling of large industrial sources to determine what each individual source plans are for the 10-year period ending in 1985. In heavy industry AQMAs, this procedure is likely to be significantly more accurate than projecting emissions with the use of economic parameters. One of the reasons why power plants were excluded from the projection methodology used for the industrial processes and other sources categories was they constitute a significant portion of emission in an AQMA. In addition, power companies generally know what future power requirements will be. Power companies have to know this because it takes approximately 10 years from the time of initial conception to having an electric generator unit built and going on line. Similarly, large industrial processes will likely know what their expansion plans are for the next 10-year period.

V. Establishment of Baseline Air Quality

A. Baseline Year

Engineering-Science used baseline air quality data that coincided with the baseline emission inventory data (the 1972 and 1973 period). In the air quality control region there were about 30 monitoring stations that recorded data for particulates, sulfur dioxide, carbon monoxide and oxidant.

B. Time Compatibility of Baseline Quality and Emissions

Since Engineering-Science used various air pollution dispersion models to calculate the future air quality for inert pollutants in the AQMA, baseline air quality data that coincided with the baseline emission data were essential for calibrating. The models were set in the calibration mode in an attempt to validate the dispersion models for the area as well as compute a calibration factor that would relate emissions to air quality more accurately. For particulate matter and using only 1/3 of the emissions in the entire AQCR, Engineering-Science obtained a correlation factor of 0.75. This would indicate that the model was fairly accurate in predicting air quality from these sources but probably, because of the incomplete emission data base, was not precisely predicting the values measured in the field. Some engineering judgment is required to relate the computer predicted values to the measured air quality data.

C. Source of Air Quality Data

All air quality data for the period 1972 and 1973 were obtained from the Maryland Bureau of Air Quality Control.

D. Accuracy and Representativeness of Data

The stations have been located fairly uniformly throughout the congested areas of the AQCR and quite likely reflect the hotspots of higher pollution concentrations. For the pollutants measured the air quality data was considered to be representative as well as accurate for air quality in the Baltimore region. Standard sampling methods had been used to collect the data. In addition, a telemetering system was used by the Maryland Bureau of Air Quality using automatic sampling instruments that would provide continuous concentrations of the various pollutants.

No statistical analyses were conducted of the air quality data in the region. However, the number of samples taken would indicate that a sufficient population had been obtained that statistically represented the air quality data for the region. Most of the data from the years 1972 and 1973 had already been incorporated into the SAROAD data bank.

E. Estimation of Air Quality from Monitoring Data

Calibration of the dispersion model for particulates showed the y-intercept background to be recorded at 41.8 $\mu g/m^3$. This y-intercept represented that portion of emissions in the area not accounted for by the model. Air quality data from rural areas of the state indicated a background concentration of particulate matter of about 35-40 $\mu g/m^3$.

VI. Air Quality Projections to 1985

A. Methods Considered

To estimate pollution levels in the year 1985, Engineering-Science considered first the use of a proportional model based on predicted emissions for the year 1985. By comparing existing baseline emissions and air quality, a simple roll-back roll-foward model could predict future air quality in relation to estimated emissions. Such a model is completely adequate for predicting hydrocarbon and nitrogen dioxide levels. For these air contaminants, longer term secondary reactions in the atmosphere are considered of paramount importanct; less significance is given to the spatial distribution of sources. Engineering-Science did consider temporal variations important, e.g., the 6 to 9 A.M. peak which may be important in estimating compliance with oxidant standards.

For suspended particulate and sulfur dioxide estimations, spatial distributions were considered to be extremely important. Therefore, a second step of modeling was required beyond that of estimating emissions to the year 1985. For this modeling effort. Engineering-Science selected the AQDM of EPA.

B. Methods Used

The AQDM has a feature that allows the planner to determine the impact on a given receptor point of any source in the AQMA. Such a model therefore offered the potential for determining the effectiveness of various control measures.

C. Estimation of Future Air Quality

For hydrocarbons and nitrogen dioxide, the 6 to 9 A.M. emissions were projected for 1977, 1980 and 1985. Air quality (oxidant) was assumed to be proportional to hydrocarbon emissions using appendix J based on the 1973 baseline relationship.

For suspended particulates and sulfur dioxide, emissions were projected for 1977, 1980 and 1985 and air quality levels were predicted by the AQDM model for 1977 and 1985. The 1980 air quality levels were bracketed by the 1977 and 1985 emission levels so no computer run was deemed necessary.

VII. Selection of Maintenance Strategies

A. Effect of SIP Controls on the Sources and Source Categories with Regard to Attainment/Maintenance

In the case of particulates and sulfur dioxides, all SIP regulations and industrial compliance schedules were assumed to be met by 1977. In the case of HC, the TCP was assumed to be followed completely with the exception of gasoline rationing and LDV retrofit.

B. Identification of Sources or Source Categories That Would Cause the National Air Quality Standards to be Exceeded

In preparing the emission inventories for all pollutants, the potential sources were divided into several source categories such as residential heating, commercial heating, industrial heating, power generations, industrial processes, refuse disposal and transportation. For the hydrocarbon inventory, a further breakdown was provided for the transportation sources. It was assumed that all hydrocarbon (oxidant) and nitrogen dioxide emissions had equal impact on air quality regardless of location and stack height. In the case of particulates and sulfur dioxide, the computer model predicted ground level concentrations that would be due to various source categories.

Air quality levels were predicted first without considering the need for maintenance measures. All source categories were listed, their contribution to future air quality identified, and the available potential control measure for those sources listed without regard to feasibility, acceptability, or impact.

C. Selection of Maintenance Strategies

The following basic types of control measures were considered for maintaining NAAQS:

- modify demand for the product
- modify raw materials

- modify production process,
- modify product output,
- modify residual effluent,
- modify assimilative capacity of the atmosphere,
- modify spatial and temporal source distribution.

Engineering-Science, Inc. utilized the "Residual Environmental Quality Management" (REQM)* system approach to systematically itemize and evaluate control measures. The effectiveness of each control measure was considered in terms of its range of effectiveness, its percentage reduction in overall emissions, and its improvement in air quality (in the case of particulates). The measures were considered independently for the first analysis. Potential control measures were listed and ranked subjectively in a matrix by several criteria such as effectiveness, timing, acceptability and so forth. The ranking of control measures was accomplished by having an air pollution task force of the Baltimore Regional Plan Commission act as a sounding board to the Engineering-Science draft.

From the sample matrix (Figure 4), one can see that the following factors were considered in selecting a combination of control measures which constitute an AQMP strategy for each pollutant.

- policy instrument to implement
- range of effectiveness
- percent emission reduction
- improvement in air quality
- direct costs
- administrative costs
- social costs
- administrative considerations
    - flexibility
    - application of control
- timing considerations
    - years before implementation
    - years before effectiveness realized
- political considerations
- legal considerations

---

*For example, see: Bower, Blair T. and Basta, Daniel J. Residuals-Environmental Quality Management: Applying the Concept, Baltimore, Maryland. Johns Hopkins Center for Metropolitan Planning and Research, October 1973, p. 12.

SOURCE CATEGORY		PERCENTAGE RANGE OF EFFECTIVENESS						%EMISSION REDUCTION	$\mu g/m^3$ IMPROVED AIR QUALITY	ECONOMIC IMPLICATIONS 1. NOT EXPENSIVE 2. MODERATELY EXPENSIVE 3. VERY EXPENSIVE												ADMINISTRATIVE CONSIDERATIONS								TIMING CONSIDERATIONS							POLITICAL CONSIDERATIONS					LEGAL CONSIDERATIONS		ENVIRONMENTAL EFFECTS					PUBLIC RESPONSIVENESS					REFER TO REMARKS SECTION
CONTROL MEASURES	POLICY INSTRUMENTS									DIRECT COSTS				ADMINISTRATIVE COSTS				SOCIAL COSTS				FLEXIBILITY				APPLICATION OF CONTROL				YEARS BEFORE IMPLEMENTATION			YEARS BEFORE EFFECTIVENESS REALIZED				LEVEL OF IMPLEMENTATION							INTERMEDIA										
		0-2	2-5	5-10	10-25	25-50	50-100			TO POLLUTER	TO CONSUMER	TO GOVERNMENT	OTHER (IDENTIFY)	PROGRAM MANAGEMENT	ENFORCEMENT	MONITORING	OTHER (IDENTIFY)	AREA INCOME	AREA EMPLOYMENT	REGIONAL PRICES	OTHER (IDENTIFY)	INFLEXIBLE	SOMEWHAT FLEXIBLE	MODERATELY FLEXIBLE	VERY FLEXIBLE	CONTINUOUS	NON-CONTINUOUS	SELECTIVE	UNIFORM	0-2	2-5	5-10	0-2	2-5	5-10	10+	FEDERAL	STATE	REGIONAL	LOCAL	PRIVATE	LEGAL PRECEDENT EXISTING	NEW LEGISLATION REQUIRED	OTHER GASES	WATER	SOLID WASTE	NOISE	ENERGY	1 LEAST ACCEPTABLE	2	3	4	5 MOST ACCEPTABLE	
CONTROL CONSTRUCTION SITES	LOCAL ORDINANCES				●				3.5	2	1	1	-	1	1	1	-	1	1	1	-				●		●	●		●			●					●		●		Y	N	X										
CONTROL OF OPEN BODIED VEHICLES	LOCAL ORDINANCES				●				3.5	2	1	1	-	1	2	1	-	1	1	1	-	●				●			●	●			●							●		Y	Y	X										
CONTROL OF DEPOSITION ON ROADS	LOCAL ORDINANCES				●				1.5	2	1	1	-	1	2	1	-	1	1	1	-		●			●		●		●			●							●		Y	Y	X										
MODIFY TIRE AND BRAKE WEAR DESIGN	DESIGN SPECS. FOR GREATER DURABILITY		●						0.7	2	2	1	-	1	1	1	-	1	1	1	-		●			●				●				●			●				●	N	Y	X										
IMPROVE MAINTENANCE OF HEATING SYSTEM	REGULATORY CODE			●					1.1	1	2	1	-	1	1	1	-	1	1	1	-			●			●	●		●			●							●	●	Y	Y	X				X						
IMPROVE FURNACE DESIGN	IMPROVE DESIGN SPECS.			●					0.5	2	2	1	-	1	1	1	-	1	1	1	-	●				●		●			●				●		●				●	N	Y	X				X						
IMPROVE DOMESTIC & COMMERCIAL BUILDING INSULATION	BUILDING CODES			●					0.8	1	2	1	-	1	1	1	-	1	1	1	-	●				●		●		●					●					●		Y	Y	X			X	X						
CONTROL ROOM TEMP FOR A C & HEATING	ADVERTISING			●					0.8	1	2	1	-	1	1	1	-	1	1	1	-				●		●	●		●			●				●	●	●	●	●	Y	N	X				X						
EXCLUDE NEW SOURCES FROM SELECTED HOT SPOTS	REVISION OF GENERAL ZONING PLAN						●		2.2	2	1	2	-	2	1	1	-	2	2	2	-			●							●				●					●		Y	N	X	X	X	X	X						
CHANGE EXISTING LAND USES	URBAN RENEWAL. REVISION OF GENERAL AND ZONING PLAN						●		5.4	1	2	3	-	3	2	1	-	1	1	1	-			●				●			●				●		●			●		Y	N	X	X	X	X	X						
	TOTAL IMPROVEMENT								20.0																																													

* NUMBER IS DIFFERENT FROM AMOUNT SHOWN ON TABLE OF MEASURES DUE TO THE SYNERGISTIC EFFECT OF OTHER MEASURES IN THIS PLAN

Figure IV-4. Sample Matrix showing evaluation data for control measures affecting domestic and commercial heating and cooling as a suspended particulate source category.

- environmental effect
- public responsiveness

When example maintenance strategies were being developed, consideration was given to the duplication, overlap or variance of the control measures as applied together and air quality reductions (effectiveness) were modified accordingly.

Several notations were used in the matrix for rating environmental, social, economic, temporal and political criteria. The symbols and numerical notations for the most part are self-explanatory. One exception may be the column entitles Public Responsiveness; the numerical entries represent the number of responses for, or in opposition to, a particular control measure. These responses were recorded at meetings of the Air Quality Task Force. Not all members responded to each measure and all groups in the BMAQMA were not equally represented. The numbers in the public responsiveness spaces should be viewed accordingly. More important, perhaps than these numbers were the comments recorded at the meetings reflecting the concerns, questions and reactions of the group toward the measures. Intermedia environmental effects were divided into five subcategories; positive effects resulting from a control measure were noted with the symbol X, negative effects with a minus symbol (-). Where there were no effects the space remained blank.

A series of four meetings was held with the Air Quality Task Force during the course of development of the example plan. At each meeting the latest version of the control measure matrices was distributed to the panel for discussion and comment. In the final version, it is believed that a new concensus had been reached for each entry.

D. Comments

The procedure for the selection of control measures worked well. It starts by assuming all source categories may be important and all control measures may be equally important. The procedure was developed by EPA Washington Environmental Research Center (WERC) and is highly recommended for use in AQMP development.

VIII. Legal Authority

As was shown in Figure 4, the legislative requirements for each control measure considered were examined to determine the existence of legal precedent and the need for new legislation.

Legal precedent, both in the form of air pollution control and prevention of a general nuisance, exists to regulate emissions from the fugitive dust sources, New, specific rules will have to be formulated and approved.

Legal implications of the energy conservation measures include the limitation on authority of local authorities; however, there is no reason to consider these measures legally not implementable. The most difficult aspect is in enforcement. In actual operation these measures will finally respond only to the economic advantage of energy conservation brought on by increased fuel costs.

Land use measures are currently within the purview of local and regional zoning authorities, and have not been used for air quality management *per se* in the Baltimore region or in the State of Maryland. Such use will require regional coordination, local regulation, and may also require state enabling legislation as deemed appropriate by the State's Attorney General.

The central legal issue raised by the measure requiring installation of emission control devices on heavy duty vehicles, and the measure requiring modification of vehicle tire and brake specifications, is that of the proper level of legal authority. State regulations for emission control on all licensed trucks in Maryland could be implemented. But because the Baltimore region lies within a heavily travelled truck corridor and is close to other states, Federal support for the regulations would be required if the measure is to be effective. Otherwise, non-conformance on the part of out-of-state vehicles would render the measure of limited effectiveness.

SUMMARY OF BALTIMORE AQMSA

POLLUTANT: Total Suspended Particulate (TSP)

NAAQ STANDARD: in $\mu g/m^3$	ANNUAL	24 HR.
EPA (Geometric mean) :	60	150
Maryland (arithmetic mean):	75/65(Serious/More Adverse)	160/140(Serious/More Adverse)

CURRENT AIR QUALITY, 1972 & 1973: 99 $\mu g/m^3$, Annual
328 $\mu g/m^3$, 24 hr. max.; second highest

EXPECTED AIR QUALITY IN 1975/1977: Same as 1972 & 1973

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD BY 1975/1977: 39%

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

Measures to control fugitive dust:
1. Control construction sites
2. Control open bodied vehicles
3. Control deposition on roads
4. Modify tire and brake design wear

Measures to reduce energy consumption:
1. Improve maintenance of heating systems
2. Improve furnace design
3. Improve building insulation
4. Control room temperatures

Land use planning measures:
1. Exclude new sources from hot spots
2. Change existing land use

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED:

The control of fugitive dust with the first 3 control measures are implemented by the local control agencies through City or county ordinances modifying tire and brake wear design will require design specifications for greater durability to be implemented at the Federal level. The Department of Transportation would probably be heavily involved but EPA would need to coordinate such efforts.

Local agencies would have to be involved in the improvement of maintenance on heating systems and on improvements in building insulation.

To improve furnace design will require coordination of private and governmental agencies such as the Building Research Advisory Board/ Federal Construction Council of the National Academy of Sciences.

Controlling room temperature will require all levels of government and private persons to coordinate.

Local zoning agencies will have to control new sources and reclassify existing land uses.

SUMMARY OF BALTIMORE AQMSA

POLLUTANT: CO

NAAQ STANDARD: ____________

CURRENT AIR QUALITY: ____________

EXPECTED AIR QUALITY IN 1975/1977: ____________

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD BY 1975/1977: ____________

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

Carbon monoxide was not included in the example plan. A preliminary analysis based on existing air quality and emission inventory indicated that the future carbon monoxide levels would not exceed the standards and therefore should not be considered in the maintenance program.

SUMMARY OF BALTIMORE AQMSA

POLLUTANT: NO_x

NAAQ STANDARD: 100 $\mu g/m^3$ annual average

CURRENT AIR QUALITY, 1972 & 1973: 117 $\mu g/m^3$ AAM

EXPECTED AIR QUALITY IN 1975/1977: 104 $\mu g/m^3$ AAM, By 1980 and 1985 emissions are expected to be below the level required to maintain the AAQS.

PERCENT REDUCTION NEEDED TO ATTAIN STANDARD BY 1975/1977: 0

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

None Recommended.

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED:

The Federal controls of motor vehicles and regulations of the State of Maryland are adequate to maintain AAQS.

SUMMARY OF BALTIMORE AQMSA

POLLUTANT: SO_x

NAAQ STANDARD: in $\mu g/m^3$

	EPA	MARYLAND	
		Serious	More Adverse
ANNUAL	80	79	39
24 hr.	365	262	131
3 hr.	1300	525	262

CURRENT AIR QUALITY, 1972 & 1973: Annual--37 $\mu g/m^3$; 24 hr. max.--131 $\mu g/m^3$

EXPECTED AIR QUALITY IN 1975/1977: Less than 1972/73. Projected SO_2 emissions inventory shows a net reduction of SO_2 of 35% by 1980 and 31% by 1985.

PERCENT REDUCTION NEEDED TO ATTAIN STANDARD BY 1975: No additional reduction is necessary

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

None are recommended.

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED:

The State of Maryland Bureau of Air Quality Control has sufficient sulfur-in-fuel regulations that apply to the AQMA.

SUMMARY OF BALTIMORE AQMSA

POLLUTANT: HC/Photochemical Oxidants

NAAQ STANDARD: 160 $\mu g/m^3$ (1-hr. max.; not to be exceeded more than once/yr.)

CURRENT AIR QUALITY, 1972 & 1973: Highest Hrly ave. 0.21 ppm; Next highest 0.21('72)
Highese Hrly ave. 0.23 ppm; Next highest 0.20('73)

EXPECTED AIR QUALITY IN 1975/1977: Highest Hourly Ave. 0.09 ppm

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD BY 1975/1977: 70% HC emissions

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

1. Improve emission controls on heavy duty vehicles.
2. Reduce use of hydrocarbon solvents.

INTERGOVERNMENTAL RELATIONSHIPS REQUESTED

1. The control of emissions from heavy duty vehicles will probably require Federal action for nation-wide coverage and uniformity. However, the State of Maryland can implement this program (retrofit). Therefore both agencies must cooperate in this effort.

2. The ban on reduction of solvent manufacturing will require cooperation from Federal, State, Regional and local government agencies. In addition private interest groups such as associations and unions should also be consulted.

Chapter V
DENVER TRIAL AIR QUALITY MAINTENANCE PLAN

I. Denver AQMSA Characteristics

The Denver Front Range Air Quality Maintenance Study Area includes the Metropolitan Denver Air Quality Control Region (AQCR), containing Adams, Arapahoe, Boulder, Clear Creek, Denver, Douglas, Gilpin, and Jefferson Counties, and Larimer and Weld Counties of the Pawnee AQCR. The AQMSA extends eastward from the Continental Divide into the plains, with the major urban centers located along the foothills of the Rockies. The greater Denver area lies within the South Platte River drainage basin with the City of Denver having an elevation in excess of 5,000 feet above sea level. Roughly 20 miles to the west the mountains reach a height of 8,000 feet above Denver; to the southwest, the land rises more gradually along the South Platte River valley. The principal areas of concern for the development of the AQMP are the population centers along the eastern foothills. In addition to the City of Denver, the AQMSA includes the major urban centers of Boulder, Longmont, and Broomfield in Boulder County, Fort Collins and Loveland in Larimer County, Greeley in Weld County, and Brighton in Adams County.

The pollutants designated to be of interest in the AQMSA are total suspended particulates, carbon monoxide, nitrogen oxides, and photochemical oxidants. The particulate problem is basically a result of the arid conditions of the region which allow for entrainment and subsequent transport of particulates during windy conditions. Manmade sources of fugitive dust include the following: unpaved roads; sand on paved roads; agriculture; land development; residential, industrial, and commerical construction; highway construction; aggregate storage; cattle feedlots; and quarrying, mining, and tailings.

The other pollutants of interest, CO, NO_x, and photochemical oxidants, result from the heavy use of motor vehicles in the Denver AQMSA. The Denver metropolitan area is characterized by a high growth rate of motor vehicles (5.2 percent per year) and the highest per capita automobile registration in the nation, one automobile for every 1.5 persons. The

Preceding page blank

motor vehicle pollutant problem for the AQMSA is exacerbated by the high elevation of the region, since operating parameters of gasoline-powered engines and the effectiveness of control devices are functions of ambient air density.

The topography of the region also adds to the high ambient concentrations. Under light, nighttime wind conditions, surface air, made relatively more dense by radiational cooling, drains down the river valley toward the northeast and lower elevations. This cold air drainage apparently stops just beyond the suburbs and the shallow air mass, which has accumulated pollutants from city sources, is frequently brought back by a wind direction reversal around noon. Under a light wind regime, crossing and recrossing of the pollutant source by the same air mass may continue for several days, thus leading to local accumulation of pollutants.

An understanding of socioeconomic characteristics of the AQMSA provides important criteria for evaluating the potential effectiveness and applicability of control measures, and for selection of measures for final plan development. The Denver region's population has grown at a fast pace in the past three decades, increasing from 3 to 4.6 percent per year. Population is decreasing in the central city as urban sprawl moves to the north and south along the front range. The suburban communities have accounted for approximately 80 percent of the area's population increase between 1950 and 1970. This trend is expected to continue with the percentage of the total metropolitan Denver population residing in Denver County going from 65 percent in 1950 to 25 percent in the year 2000.

Growth in Larimer and Weld Counties has been even more dramatic, especially for their major cities. While the growth rate has been fairly consistent in the past, the recent trend has been an acceleration of growth. Between 1960 and 1970 Fort Collins had a 73.2 percent rate of increase, Loveland had a 66.6 percent increase, and Greeley had an increase of 47.8 percent. It should be noted that the two cities that increased the most between 1960 and 1970 were both located in Larimer County which itself underwent a growth of 68.5 percent over the previous decade. Weld County, as a whole, had a growth rate of only 23.4 percent during the same time period, which is less than that for the entire State and indicates a slow rate of increase in population in the rural districts.

Residence patterns are crucial in regional development planning, public transit system development and selective transportation control measures designed to alter travel patterns to attain a shift in modal mix that both meets transit needs and minimizes air pollution and other environmental degradation. Low density and dispersed residential development patterns characterizing the regions are expected to continue with circumferential growth occurring from city centers and radial growth along transportation corridors. Other housing trends, such as a declining number of persons per housing unit and popularity of low density residences, are expected to continue.

Approximately two-thirds of the employment growth between 1964 and 1970 occurred in Denver County, while about 95 percent of the population growth was in surrounding counties. This indicates an inward work trip transportation flow for the region. Projected employment density patterns indicate that employment will continue to be concentrated in the core region, thus requiring continued commuter traffic. Some services have followed the residential development in the suburbs, but as yet no proliferation of industrial development is apparent.

Based on a census week in 1970, only 4.2 percent of the workers in the Denver SMSA traveled to work on public transportation. The majority of the workers, 74.8 percent, drove private automobiles while 10.4 percent were passengers in private autos, and 8.5 percent walked to or from their place of work.

II. Intergovernmental Cooperation

A. Agencies Contacted

1. State

Colorado Air Pollution Control Commission - The duties of the Colorado Air Pollution Control Commission include the development and maintenance of a comprehensive program for prevention, control and abatement of air pollution throughout the entire state, including a program for control of emissions from all significant sources of air pollution; the promulgation of ambient air goals for every portion of the state; the adoption and promulgation of ambient air quality standards and emission control regulations; the receipt of and, at its discretion, the hearing and determination of violations; the receipt of applications for variances and, at its discretion, the review of any variance order or determination of the variance board to which such applications may have been transmitted. The Commission must also hold a joint meeting with the State Board of Health during the month of October of each year in order to hear public comment on air pollution problems within the state and to answer questions from the public concerning the administration and enforcement of promulgated rules and regulations.

Colorado Air Pollution Control Division - The Division is empowered to conduct studies and research with respect to air pollution, the control, abatement, or prevention thereof; determine if the ambient air standards are being violated in any area of the state; enter and inspect any property, premise, or place for the purpose of investigating actual, suspected, or potential source of air pollution; furnish technical advice and services; notify any affected jurisdiction of standards that are not being met; and issue contaminant emission notices. The Division also has the authority to enforce compliance with the promulgated emission control regulations.

The Department of Health, in which the Air Pollution Control Division was established, is designated as the "state agency" for all purposes of the Federal Clean Air Act, as amended, and regulations promulgated under said act. The Department of Health accepts and supervises the administration of loans and grants from the Federal government (and from other sources, public or private) that are received by the state for air pollution control purposes.

Colorado Division of Planning - The Division of Planning serves as an advisory and coordinating agency with no regulatory authority. It was created within the Department of Local Affairs to, among other things, prepare planning "for meeting problems in the areas of highways, air and water pollution, water supplies, sewage disposal, recreation, urban and nonurban growth, transportation, education, industrial and commercial development, and related matters."

The duties of the Division of Planning are primarily those of assistance in the gathering and using of data. The population statistics, estimates, and projections prepared, maintained, and interpreted by the Division of Planning are designated as the official data. The Division of Planning must prepare and periodically revise an inventory of the public and private natural resources, major public and private works, and other facilities and assemble information deemed to be important for the planning and development activities of the state.

The Division of Planning's primary input to the development and implementation of an air quality maintenance plan, aside from the use of its data, is the use of its function as the A-95 clearinghouse. The Division of Planning is also the lead state agency in HUD 701 planning.

All master or zoning plans, prepared by any region, county, or district planning commission, must be submitted to the Division of Planning for review and comment before adoption or certification. The planning commission submitting such plans is not bound by such advice or criticism.

Colorado Land Use Commission - The Colorado Land Use Commission was established within the Office of the Governor to provide the leadership necessary to encourage planned and orderly use development. For the past three years the Land Use Commission has been working to identify a program that will provide a framework and a process whereby the State of Colorado and its political subdivisions can guide future development. This has culminated in a report entitled, "A Land Use Program for Colorado," which is briefly discussed below.

Of particular interest to the development of an air quality maintenance plan is the program outlined for the environment. The report recommends a three-pronged approach to the achievement of environmental goals. As a first element, environmental inventories would be prepared and plans made that reflect the location of significant natural amenities and ecosystems, as well as scenic, cultural, and historic resources. The identification of these critical environmental areas will, in turn, guide the administration of land use and environmental regulatory programs, including a new-development permit system.

This permit system would apply to all developments located in areas of critical environmental concern and to proposed activities of regional or State significance. The granting of a permit will be the function of regional permit boards within the five regions of the State, with appeals to a State Permit Review Board. The criteria for determining when a permit is needed, whether it should be granted, and what restrictions or conditions should be attached to it will thus be responsive to regional differences. Permit decisions will reflect a comprehensive review of the proposed development's effects on the environment, public services, and existing public infrastructure. Public hearings on permits will be conducted at the regional level, with an opportunity for citizen participation. This permit system, along with strengthening of local land-use controls, and improvements in state regulation of environmental quality, make up the second element in the recommended environmental strategy.

The third element looks toward the creation of a Special Land Agency, a state-owned corporation empowered to acquire environmentally critical lands, or partial interests in these lands, such as scenic easements, and to help provide accessible recreational opportunities for Coloradans. In urban and urbanizing areas, the Commission suggests the creation of linear parks along rivers and streams or other environmental corridors. Such parks would preserve both shorelines and other environmental qualities.

2. Regional

Joint Regional Planning Program - Denver SMSA - The responsible agency for comprehensive planning in the Denver SMSA is the Denver Regional Council of Governments (DRCOG). The responsibility for continuing, comprehensive, and cooperative (3-C) transportation planning rests with the Joint Regional Planning Program (JRPP). The JRPP is a cooperative transportation planning effort carried out jointly by the DRCOG, the Regional Transportation District (RTD), and the Colorado Division of Highways (CDH).

Consistent with its role as intergovernmental coordinator for the SMSA region, the DRCOG coordinates the joint planning efforts with federal, state and local units and agencies of governments. In carrying out this role, the DRCOG makes application for federal assistance to the planning program, coordinates the planning program with the planning for all modes of transportation, coordinates the needs and findings of the planning program with units of local government, coordinates with state planning efforts, and, upon adoption, certifies land use and public transportation plans to the federal government. General policy guidelines are established cooperatively by the policy bodies of each agency. The staffs of the DRCOG, the RTD, and the CDH have responsibility for management and control of the planning elements and tasks assigned to their respective agencies. Specific planning responsibilities of the agencies are outlined below.

DRCOG Activities - Those activities of the DRCOG that are instrumental in the JRPP are detailed below:

Comprehensive Planning Information - Preparation of regional goals and objectives, estimates and projections of population counts and characteristics, socioeconomic/employment information, land use, identification of natural and man-made physical characteristics influencing regional development, identification and projection of community facilities and service requirements, and preparation of land development criteria and standards.

Urban Development Plans - Preparation, analysis and evaluation of regional development plans based upon alternative development policies.

Joint Development with RTD and CDH of Transportation Plans - Preparation of transportation information, development of travel pattern data, preparation and evaluation of transportation models, preparation of transportation system criteria and standards, forecasts of regional travel demand, preparation and testing of alternative transportation corridors, and evaluation and selection of highway and public transportation plans.

Continuing Development of Short and Long Range Plans and Planning Information - Continuing development and analysis of indicators of regional growth and change; coordination of planning program findings with public transportation operators and with the Colorado Division of Highways; monitoring of public action programs that may affect the planning program and development of short-range highway transportations plans that, combined with short-range public transportation improvements, will tend to raise the overall level of transportation service in the region.

RTD Activities - These activities are listed below:

Joint Development with DRCOG and CDH of Transportation Plans - Preparation of public transportation information, travel pattern data, transportation models, transportation system criteria and standards, regional travel demand, alternative transportation corridors, and evaluation and selection of public transportation plans.

Detailed Long-Range Public Transportation System Plans - Estimates of system usage, line and station location studies, preliminary vehicle design, preparation of operating plans, preliminary engineering studies, detailed cost benefit analysis, preparation of capital and operating cost estimates, and architectural and urban design studies.

Implementation Program - Preparation of financial program and construction phasing, examination of organizational and legislative programs, and preparation of a step-by-step implementation program.

Short-Range Improvement Programs - Analysis of bus ridership pattern, analysis of route structure, identification of role for local transit service, analyzing deficiencies in service, and preparation of a short-range public transportation improvement program.

Demonstration Programs - Identification, development and implementation of programs that will aid in ultimate development of the long-range public transportation plan and serve to demonstrate that modern public transportation is a viable alternative to automobile travel.

Public Education Program - Development and implementation of a community interaction and information program to ensure that any new public transportation plan is responsive to the needs of the entire community and to provide for effective citizen participation in the public transportation planning process.

Community Approval - Sponsorship of public hearings, modification of public transportation plans as required, and submission of a plan for the development, maintenance, and operation of a public transportation system to the voters of the District.

Implementation of Plan - Upon favorable approval of the electorate and sale of authorized bonds, unification and operation of existing public transportation systems as well as construction of new facilities in accordance with the plan.

Continuing Development of Short and Long Range Plans - Together with the Council of Governments, continuing preparation of short and long range plans to meet public transportation needs and requirements of the region.

CDH Activities - The activities of the CDH, relating to the Joint Regional Planning Program, are given below:

Joint Development with DRCOG and RTD of Transportation Plans - Preparation of highway transportation information, travel pattern data, transportation models, transportation system criteria and standards, regional travel demand, alternative transportation corridors, and evaluation and selection of highway transportation plans.

Continuing Development of Short and Long Range Plans - Contributing to preparation of short and long range plans to meet highway transportation needs and requirements of the region.

Implementation of Highway Plans - Budgeting, engineering and construction of highway improvements resulting from cooperative planning program.

Mechanism for Planning Coordination - There exists a Memorandum of Agreement between the DRCOG, the RTD, and the CDH, signed on April 16, 1971, and currently in effect. The DRCOG, as the designated areawide planning agency and coordinating member of the JRPP, has the responsibility to administer and coordinate all transit planning funds. The DRCOG also has the authority to contract with other agencies to provide and administer planning monies. HUD 701 planning, A-95 review, and Sections 201, 208, and 303 water quality planning are some of the functions the DRCOG is supposed to perform in the Denver SMSA.

In order to provide continuing liaison between federal, state, and local agencies, and provide for effective input of their expertise, concerns and desires, the JRPP has designated the DRCOG's Regional Planning Advisory Committee (RPAC) as a technical advisory committee to the transportation planning process. Voting members of the RPAC represent the cities and counties of the region. While membership is not limited to particular professional disciplines, members are usually city planners or engineers. Also included on the committee, in a non-voting, associate capacity, are representatives of the Colorado Division of Planning, the Colorado Land Use Commission, the CDH, the RTD, the Federal Highway Administration, the Department of Housing, the Bureau of Outdoor Recreation, and the Federal Aviation Administration. Meetings of the RPAC are held at least monthly. While the transit operating agencies of the region are not directly represented on the RPAC, representation is provided through the Committee's two members from the City and County of Denver.

Larimer-Weld Regional Planning Commission - The only regional planning commission that has been created in the Denver AQMSA, other than the DRCOG, is the Larimer-Weld Regional Planning Commission. The Larimer-Weld RPC has developed and adopted a master plan that states the goals and policies for the Larimer-Weld region and provides the development plan for these two counties. This plan is not deemed to be an official advisory plan unless adopted by the planning commission of the municipality or county affected. HUD 701 planning and A-95 review are two of the responsibilities of the commission.

Local Pollution Control Authorities - Colorado has a very strong interest in maintaining control over local problems in the jurisdiction of interest. As much as possible, initial regulatory control is placed in the local authorities with final control by the state only if necessary. The Colorado Air Pollution Control Act delegates to the local governmental agencies the authority to enforce the rules and regulations adopted by the Air Pollution Control Commission.

The local air pollution control authorities in the Denver Air Quality Maintenance Study Area, none of which were contacted during this study, are listed below:

County	Agency Title	Location
Adams	Tri-County District Health Department	Englewood
Arapahoe	Tri-County District Health Department	Englewood
Boulder	Boulder City-County Health Department	Boulder
Clear Creek	-	-
Denver	Denver Department of Health and Hospitals Denver Building Department	Denver Denver
Douglas	Tri-County District Health Department	Englewood

County	Agency Title	Location
Gilpin		
Jefferson	Jefferson County Health Department	Lakewood
Larimer	Larimer County Health Department	Fort Collins
Weld	Weld County Health Department	Greeley

Local Planning Commissions - All counties in Colorado must have, and any municipality may have, a planning commission. Any such planning commission must prepare a comprehensive plan (master plan) for its jurisdiction. These plans are officially adopted (after public hearings), and must be considered before decisions are made about certain types of facilities. Generally, the master plan has little legal effect on private actions as there is no requirement that zoning be in accordance with the community master plan. In Weld County, at present, it is the policy to rely on the comprehensive plan in zoning decisions. Municipal, but not county, planning commissions must also review the locations of public thoroughfares, utilities and open spaces.

B. Responsibilities of Agencies

1. AQMP Preparation

The inputs of the various agencies to the maintenance plan preparation follow naturally from their role in the region as described above. Table 1 presents a matrix that summarizes these inputs.

2. AQMP Implementation

The plan implementation responsibilities of the various agencies are also a direct result of their role in the region and the available legal, organizational structure. The maintenance plan for the Denver AQMA relies primarily upon the authority vested in the Air Pollution Control Commission and the Land Use Commission as described below.

3. Responsibility Assignments--In the preparation of the Denver Example AQMP, the existing infrastructure was examined to determine the path of least resistance for generating a feasible cooperative mechanism.

The first item considered was enabling legislation. In Colorado there are two primary legislative mandates for use in maintenance planning. The first is the Air Pollution Control Act of 1970 which established the

Table V-1. AQMP PREPARATION INPUT

Preparation	Provide land-use plan	Provide transportation plan	Provide open space/ recreational plan	Participate in A-95 review process	Review EIS	Prepare EIS	Provide growth projections	Review growth projections	Provide emission projections
APCC and APCD					X			X	X
DRCOG	X	X	X	X	X		X	X	
RTD	X (Joint part. with DRCOG)	X				X	X	X	X
CDH	X (Joint part. with DRCOG)	X				X	X	X	
Div. of Planning				X	X		X	X	
LUC	X		X		X		X	X	
L-W COG	X	X	X	X	X		X	X	
County Planning Agencies	X		X		X		X	X	
Local Planning Agencies	X		X		X		X	X	

Air Pollution Control Commission. The second is Colorado House Bill 1041 which amends previous land use law. Colorado law also provides for the adoption, by municipal planning commissions, of regulations to govern the subdivision of land. The statute contains a list of features that may be regulated, including "light and air." The RTD is specifically provided for in legislation and has relatively broad powers to both plan and implement a program of mass transportation, including authority to tax, incur debts, and issue bonds. Thus, a search of existing legislation serves as the primary means of identifying agency responsibility.

A second source of agency identification is examination of what has already been done in terms of socioeconomic projection, air quality data collection, and other specific programs. This serves to identify technical ability to perform the task. In the case of Denver, land use, highway, and transportation plans are already available, though in ever changing form, through the JRPP. The JRPP is a joint effort among DRCOG, the CDH, and the RTD. In doing their planning, population and employment projections are generated. Land use planning on a macroscale is already available through the Land Use Commission.

In addition to their roles in preparing comprehensive plans, both DRCOG and the Larimer-Weld COG serve as forums for discussion. As voluntary associations of county governments they have no legal authority per se. They do have, however, political influence resulting from the councils' memberships. In short, while COG's don't exhibit legally binding authority, they do have the potential for exercising significant political influence.

C. Recommended Organizational Relationships

For the Denver AQMSA, it is recommended that the Air Pollution Control Commission and the Land Use Commission undertake the development and implementation of the maintenance plan as a joint venture. This appears to be the most suitable organizational structure, given the land use law as well as the Air Pollution Control Act. Each of these pieces of legislation gives large amounts of power to the respective agencies. The joint venture is to be accomplished by the exchange of information between the two groups. Further, it is suggested that periodic meetings be established where both commissions are represented. This will allow for any problem areas to be resolved. Obviously, the other respective responsibilities of the commissions will change in no way. This organizational structure increases the work load of each body, but only by one-half of what it would be if sole responsibility were delegated to one commission.

D. Problems and Suggested Solutions

Several obstacles may hinder the creation of an adequate intergovernmental cooperation mechanism. The first arises because of the nature of air quality maintenance. Maintenance, perhaps even more than air quality attainment, must be coordinated with many other social goals. Given the fact that air quality maintenance is perpetual in nature, its objectives must be coordinated with these other goals. For this reason, land use and transportation planning, at least a priori, are good candidates as maintenance measures. Their use as a strategy allows for simultaneous movement toward a number of objectives. The major problem arising from their use is the necessity for including additional agencies in maintenance plan development. The solution to this problem is identification of key bodies for accomplishing each objective and coordination from the top of the hierarchical structure. This was the approach used in the example plan for the Denver AQMSA.

The second problem area is really at the heart of maintenance plan development. Air quality maintenance, while not a new concept, is an unknown as far as institutionalization is concerned. At present there exist no laws or bodies with the explicit function of providing for the maintenance of air quality. Thus, the problem of intergovernmental cooperation is compounded. Existing legislation must be looked at, interpreted in the light of air quality, and roles to agencies must be assigned.

Along these same lines, there is the problem of how well the selected bodies will work with one another. At the present time, information links can only be suggested. Only after the concept of maintenance has been around for a while can one be assured that these links will be sufficient. An alternative, if such an informal arrangement does not work, is the creation of an ad hoc committee, by the governor, on air quality maintenance. This would be made up of members from both of the aforementioned bodies.

III. Baseline Emissions Inventory

A. Baseline Year

The baseline year for the emissions inventory used in the development of the example AQMP for the Denver AQMSA was 1972 for most of the pollutant sources. This year included the most recent update of NEDS for this region and also was the year for which fugitive dust emissions and traffic volumes for the Metropolitan Denver highway network were provided. However, for mobile source emissions in Boulder, Fort Collins, and Greeley, it was necessary to use 1968 as the base year from which projections were made, due to the lack of more recent data.

B. Source of Data

1. Point Source Emissions

Base year point source emissions are given for all pollutants in NEDS. The NEDS point source data were provided by the Environmental Protection Agency, Region VIII, and contained listings of the individual point sources, including names of companies, location, and process rates.

2. Line Source Emissions

The emissions of CO, HC, and NO_x were calculated by use of the Kricher and Armstrong emission factors along with diesel emission estimates from AP-42 for the grid squares (see below) for which estimates of traffic volumes for the current Metropolitan Denver highway network (1972) had been made. This procedure involved a summation over low mileage emission factors, emission control deterioration, weighted annual travel, and different speed types. Evaporative hydrocarbons were also accounted for in the calculation. The basis for the traffic data used in the emission calculations was an origin-destination survey and travel forecast carried out under the JRPP.

Base year mobile source emissions were also derived for Boulder, Fort Collins, and Greeley based upon 1968 VMT data as a function of road type as listed in the *Classification, Needs, and Fiscal Study* prepared for the CDH by Wilbur Smith and Associates.

3. Area Source Emissions

Non-fugitive area source emissions of particulates and non-mobile related CO, HC, and NO_x area source emissions were used as provided in the NEDS. Fugitive dust emissions were provided for each county in the AQMSA in the PEDCo report, Investigation of Fugitive Dust - Sources, Emission, and Control - For Attainment of Secondary Ambient Air Quality Standards, Colorado.

C. Allocation of Emissions

For all particulate sources, a universal transverse mercator (UTM) coordinate system was used. Point sources included in NEDS had UTM coordinates already assigned to them and these were located accordingly. Non-fugitive particulate area source strengths rounded to the nearest 100 tons/year, were provided in UTM grid squares on a map printout of each county by EPA at Research Triangle Park. Fugitive dust emissions were also allocated to the grid squares by first disaggregating the county into zones representative of the current land use (croplands, urban area, woodlands), assigning the emissions for the various activities to the corresponding land uses (e.g., agricultural emissions were assigned to cropland), and then the emission densities, tons/year/4 km^2, were calculated for each grid square.

Emissions of CO, HC, and NO_x were allocated to the 240 grid squares (2 miles on a side) used for air pollution studies by APRAC. These emissions were calculated from the average daily VMT data provided by the Research and Special Studies Branch of the CDH for the same grid squares. It was not necessary to convert these to UTM coordinates as the change in emission densities over time was to be the determining factor in the development of maintenance measures.

D. Emission Control Assumptions

1. EPA Regulations

The only EPA promulgated emission regulations used were those that apply to motor vehicle related emissions under the Federal Motor Vehicle Control program. Modifications were made in the emission and deterioriation factors to account for the fact that high altitude emission standards will first apply to 1977 year vehicles and that the interim standards are assumed to be extended through the 1977 model year.

Other strategies promulgated by EPA to control motor vehicle pollution, were assumed in the projection of emissions. These were assumed to be implemented on or before 1977:

1. Semi-annual inspection and maintenance using the idle test mode (failure rate = 50 percent)

2. Air bleed retrofit on pre-1968 light duty vehicles

3. Air bleed retrofit with exhaust gas recirculation on 1968 to 1974 light duty vehicles

4. A maximum reduction in light duty vehicles VMT of 15 percent for all VMT-reducing strategies.

Hydrocarbon emissions from stationary sources were assumed to be controlled to the degree indicated in the EPA-promulgated transportation control plan.

Other EPA regulations, e.g., New Source Performance Standards, were not considered due to the already high degree of control on existing sources through the application of Colorado regulations and the small contribution any influx of new sources would have on the total air quality.

2. Colorado Regulations

Regulation No. 1 of the State of Colorado, promulgated to control the emission of particulates from point sources, was applied to all point sources of over 100 tons/year particulates. This was accomplished by applying the process rate based regulations to the process rates as given in NEDS. Section II-D of Regulation No. 1, a recently promulgated section concerning the control of fugitive dust, was applied to the emission levels of fugitive dust.

3. Local Regulations

No local regulations were discovered during the course of this study and therefore none was applied.

E. Emission Factor Assumptions

Except in the case of motor vehicle emissions, emission factors were assumed to be consistent with those of the emission data base development, both in NEDS and by PEDCo. For mobile source emission estimates, as stated earlier, modifications were made in the emission and deterioration factors to account for the problems associated with high altitude.

F. Problems

A minimal number of problems were encountered at this stage of the plan development. As is the case throughout the maintenance planning procedure, there is some inconsistency of data bases. This was evident by comparing the point source emissions given by PEDCo and that in NEDS. As NEDS was supposed to be more accurate and detailed, and no evidence to refute this was developed, this was the data base used.

It was also felt that insufficient accuracy was represented in the area source emissions allocated in NEDS where a rounding to the nearest hundred tons/year occurred. This deficiency was more pronounced in rural areas where many grids were assigned either no area sources or 100 tons/year. A similar lack of accuracy was also evident in the allocation of fugitive dust emissions by gross land use areas. Solutions of these problems were not attempted due to the limited time allotted to the example plan development.

G. Recommendations

Establishment of a baseline emissions inventory requires extreme care since it is the basis for long term projections of emissions and resulting air quality. Since the projection techniques and factors incorporate inherent uncertainty for a 10-year period, it is necessary to provide the most accurate base possible from which to predict.

IV. Emission Projections

A. General Methodology

The development of projected emissions for the Denver AQMSA assumed that emissions would grow in direct proportion to various parameters that relate to the size of a source. This is not an unreasonable assumption as many of the emission regulations for industry are applied on the basis of process rates and residential pollution is expected to grow with the number of residents.

Growth Projection Data

In the Denver metropolitan area, the JRPP provided projected levels of population and employment by industry type within small zones called superdistricts for 10-year intervals to the year 2000. Outside of the JRPP superdistrict areas official state population projections through 1980 were available for each county from the Division of Planning. Other population and economic estimates included OBERS data on an AQCR basis and county planning commissions' data. It was found that significant discrepancies existed between these two sources and the official projections of the JRPP and the Colorado Division of Planning. It was decided to rely upon the projections of the JRPP and the Division of Planning's projections to the maximum extent possible as these were not only the official projections but also the agencies from which these projections came are primarily responsible for growth planning in the region.

Travel activity data were also used for projecting emissions. Data on both present and projected automobile travel were supplied by the Colorado Division of Highways. Vehicle-miles traveled data were available by highway functional classification and by geographic area. The major problem is that these data are given only for the years 1968 and 1990 for non-JRPP areas and for 1972 and 2000 in the case of the metropolitan Denver area. A linear interpolation was used to generate traffic activity for intervening years.

B. Pollutant and Source Specific Methodology

1. Particulates

Point Sources - Projections of particulate emissions from point sources were derived from a review of regulations controlling these emissions and parameters of economic growth, as discussed above, during the period of interest. Sufficient information was not available to allow for spatial allocation of projected emissions so projections are assumed to apply to the location of existing sources.

Initial projection of the 1972 NEDS data to 1975 emission levels was accomplished by applying the Colorado regulations to the process rates for all sources producing more than 100 tons particulates per year. This in effect provides a new base year, 1975, from which other projections are made. The actual projections of emissions were made by applying the employment growth rates for commercial-institutional and industrial employment sectors within each zone to the 1975 emission levels for the corresponding source sector.

NEDS Area Sources - Area source emissions of particulates provided by the NEDS, are projected to 1975, 1980, and 1985 on much the same basis as particulate point sources; however, no regulations are applicable to these emissions to provide an initial decrease in emissions. In addition to employment projections by source sector, population growth rates are used to project emissions from the residential sector. Projections of particulate emissions from motor vehicles are made by assuming that the total emissions from the motor vehicles grow with the increased VMT. Unlike the direct application of population and employment growth rates to the emissions, the VMT growth rates are reduced by the degree of control of particulate emissions expected due to the installation of catalytic mufflers in new cars.

Fugitive Dust Sources - The fugitive dust emissions were projected to 1975, 1980, and 1985 by applying the regulation recently promulgated by the Colorado Air Pollution Control Commission and the appropriate travel and socioeconomic growth parameters to the corresponding source sectors for fugitive dust. The fugitive emission reductions are determined for unpaved roads, land development and construction activities, and mining and storage operations based on the analysis of control measures provided in the PEDCo study thereby giving a new baseline year of 1975 to which the growth factors can be applied.

Several source categories were seen as unlikely to greatly change in activity in the AQMSA during the 10-year period: agriculture; quarrying, mining and tailings; aggregate storage; and cattle feedlots. In addition, control measures on an increasing number of unpaved roads were expected to offset increased traffic on present low-volume unpaved roads. Emissions due to sand on paved roads was projected to increase in direct proportion to total VMT; land development and residential-commercial construction was calculated based on JRPP projections of land use; highway construction activity was projected from the JRPP estimates of land use for roadways.

2. Carbon Monoxide

Point and Area Sources - The emission levels of carbon monoxide from point and non-vehicular area sources were assumed to be negligible when compared to motor vehicle sources so no growth is projected for this source sector for this pollutant.

Mobile Sources - The projected emissions of carbon monoxide were made by applying the emission factors and control strategies discussed earlier to the projected vehicular activity determined by a linear interpolation of the data given for 1972 and 2000, or 1968 and 1990 for non-JRPP urban areas.

3. Hydrocarbons

Point and Area Sources - The projected emissions of hydrocarbons from point and area sources were assumed to be those given in the EPA promulgated transportation control plan for the Denver metropolitan area.

Mobile Sources - The projected emissions of hydrocarbons were made on the same basis as for carbon monoxide discussed above.

Nitrogen Oxides

Point Sources - The growth rates for nitrogen oxide emissions was broken down by power plant, industrial, commercial-institutional, and residential sectors and are calculated only for the metropolitan Denver area as a whole. The growth rates applied were those of employment or population in the various sectors and ranged from 1.0 for power plants to 1.4 for industrial and residential related sources over the time period 1975-1985.

Area Sources - The impact of nonvehicular area sources on the air quality was considered to be negligible so no projections were made for this source sector.

Mobile Sources - The projected emissions of nitrogen oxides were made on the same basis as for carbon monoxide discussed above.

4. Problems

The major problem in the projection of emissions was the lack of a defined methodology for determining and processing the growth parameters. An additional problem was the coordination of the various data sources. Not only is the data often generated for specific geographic areas that are not congruent, but similar data from different sources will be inconsistent.

C. Recommendations

The Booz-Allen document, Manual of Instruction for Projecting County Emissions, Volume 7 of the Guideline series, provides a workbook approach for calculating emissions using the best available sources and should provide some alleviation of the problem of projecting emissions.

Suggested guidelines for standardization of data, especially directed at the long-term need for continued data handling, include the following:

1. Input should be encouraged to be based locally and the projections (with confidence levels) should be made for the smallest possible unit.

2. There should be requirements that all planning activities (air quality maintenance, Section 208 - water quality) and other infrastructures use this consistent data base to ensure comparability of projections.

V. Establishment of Baseline Air Quality

A. Baseline Years

The establishment of baseline years for the individual pollutants being considered depends on both the availability of acceptable air quality data and the guidelines for selection of the concentrations to be used in the development of control strategies. For this reason, each pollutant may be expected to have a different baseline year, especially if there is no air quality trend evident due to emission regulations.

For particulates, no overall trend in the annual geometric means appeared to occur during the period 1970 to 1973. Since the individual 24-hour concentrations were not yet available for 1973 and the annual data had not yet appeared in SAROAD, the development of baseline data was restricted to the years 1970, 1971, and 1972. The selection of the no-trend option provided for the use of a 3-year average annual mean of 130 $\mu g/m^3$ in Denver County. In effect, no air quality baseline year was determined for particulates.

Carbon monoxide measurements were made at only one station in 1971 and 1972 with five additional monitors being added in 1973. A review of the measured 1-hour and 8-hour concentrations indicated that control of the 8-hour concentrations would ensure the attainment of the 1-hour standard also. As no trend could be definitely established, examination of the second highest 8-hour concentrations for the 3-year period indicated that the control strategies would be based on the 1971 second high of 31.6 $\mu g/m^3$

The study of the oxidant concentrations reported since 1970 by a variety of methods, including the approved chemiluminescence method begun in 1973, indicated that the second highest 1-hour concentration of oxidants observed was 490 $\mu g/m^3$ and occurred in 1973. Therefore, 1973 must be the air quality baseline year for strategy determination.

Data collected in Denver in 1972 provide the only set of nitrogen dioxide measurements made with a currently acceptable analytical method, that is also statistically adequate for the determination of an annual mean. The annual arithmetic mean obtained from the 6759 1-hour observations made by an instrumental colorimetric method during the year was 73 $\mu g/m^3$.

B. Compatibility with Emission Baseline

The time compatibility of the baseline air quality and the emissions was either assumed or ensured depending upon the methodology for selection of the air quality base year. As a nontrend option for particulates was selected, it was assumed that the emission levels given in NEDS and PEDCo study had not significantly changed over the 3-year period. This was a reasonable assumption due to the effective dates of regulations controlling these sources.

Since the air quality levels for carbon monoxide, nitrogen oxides, and photochemical oxidants were to be used for the determination of allowable emissions, it was necessary to calculate the emission levels of each pollutant for its air quality baseline year selected above. Nitrogen oxides emissions were already based in 1972, the same year as the NO_x air quality baseline year. For carbon monoxide and hydrocarbons (photochemical oxidants) it was necessary to interpolate the emission levels one year from the 1972 baseline year to 1971 and 1973 respectively. These interpolations were done on the VMT data with consideration to emission controls.

C. Air Quality Data Sources

Air quality data considered were those measured at the Denver CAMP station and by the State of Colorado as reported in the National Aerometric Data Bank. In addition, since the NADB did not contain an updated complete set of data from many of the more recent monitors, it was necessary to contact the CAPCD and the EPA Region VIII office directly.

D. Accuracy and Representativeness of Data

Consideration was given to the method of sampling, sampler location and placement, and the number of samples from each sampler in the determination of the baseline air quality. From July 1970 until July 1973, the KI methods (both alkaline and colorimetric neutral) were used for the determination of total oxidants; however, these values were exceeded by subsequent values measured by the approved chemiluminescence technique.

Similarly for NO_x, the acceptable analytical method was considered to be statistically adequate for only one site for one year. In reviewing the reported particulate concentrations, it was decided to ignore the actual highest 3-year average concentration of 170 $\mu g/m^3$ due to the low sampling height of 9 feet at this station. Other assumptions, including the no-trend option, were used to select a reasonable baseline particulate air quality value.

No analyses were performed to determine whether specific problem areas (e.g., fugitive dust from agricultural emissions) were adequately represented by the current monitoring network. Generally, most of the samplers were in an urban to suburban setting. Along the same line, no investigation was made to determine any needed changes in the current monitoring network.

E. Estimation of Air Quality from Monitoring Data

Current guidelines on the handling and interpretation of air quality data were adhered to. Therefore, only actual air quality data were used and no estimation of the air quality was performed.

F. Problems

A basic problem in determining the base year air quality data is the non-availability of current data that would be most representative of the present situation. Much of the data is not readily retrievable in the NADB. In this study it was necessary to search state and federal (the Regional EPA office) data files to complete the data base.

VI. Air Quality Projections to 1985

A. Methodology Considerations

It is not necessary to make projections of air quality in order to determine needed reductions in emissions to compensate for expected growth. However, where different types of sources are to be controlled to varying degrees, and the impact of the emissions of the various source sectors on air quality is not parallel, it is useful to project the actual air quality impact of each source sector separately and to combine these impacts at the intervals of interest.

For carbon monoxide, hydrocarbons, and nitrogen oxides the primary source sector is mobile sources so that it is only necessary to project the total emissions over the 10-year interval to determine what types of control measures are needed. The contributions to the particulate concentrations, on the other hand, come from basically three source sectors - point, area, and fugitive, or only the latter two after point source regulations are applied.

The emission projection methodologies have already been outlined in Section IV so only the method used for projecting the particulate air quality is described below.

B. Methods Used

Atmospheric modeling was used to help provide projections of particulate air quality thereby helping in the analysis of the spatial concentration pattern and changes of pattern due to variations in source strengths during the period of interest. By calibrating the model with the actual air quality measurements, it is possible to project the air quality over a much larger area than that covered by the network of stations.

For purposes of air quality projections, the Climatological Dispersion Model (CDM) was used to calculate average annual ground level air pollutant concentrations due to point sources. Area and fugitive dust source contributions were evaluated by means of the Hanna-Gifford Area Source Model. The CDM was chosen for point sources with buoyant plumes since it can account in more detail for the meteorological variables. The Hanna-Gifford model has the advantage that the air quality within a particular grid square may be related directly to the emission density within that square and those immediately adjacent.

The modeling was performed on the 1972 emission levels for point, area, and fugitive sources and for 1975 point source emissions to provide an estimate of the impact of the point source regulations on air quality. The percentage contribution of each source sector to the total calculated concentration was maintained and projected to 1975, 1980, and 1985 by use of the emission growth factors derived earlier. By projecting the percentage contributions, new calculated concentrations could be determined as well as new percentage contributions from each source sector.

C. Determination of the Potential for NAAQS Violation

The extent to which a pollutant might exceed the National Ambient Air Quality Standards between 1975 and 1985 was determined by separate methodologies for particulates and mobile source pollutants. As described above, actual projections of particulate air quality under current regulations were made for the years 1975, 1980, and 1985. These projections demonstrated that at most sampling sites the secondary standards for particulates would continue to be exceeded and the primary standard would not be attained in the urban areas of the AQMSA. Additional reductions to obtain the primary and secondary standards in 1975 in downtown Denver were determined to be 46 and 64 percent, respectively. In the more rural regions, the attainment of the secondary standards required a further reduction of 43 percent.

Instead of air quality projections, allowable emission levels for carbon monoxide and hydrocarbons were calculated by applying the appropriate rollbacks of 68 and 67 percent, respectively, to the emission levels in the air quality baseline year. The baseline air quality for nitrogen oxides allowed for an increase of 37 percent over the base year emission levels. These allowable emission levels were then compared with the projected emissions to determine whether the particular air quality standard would be violated. This review indicated that the nitrogen oxide standards would not be violated throughout the 10-year period of interest and that, once attainment of the NAAQS was achieved for carbon monoxide and photochemical oxidants, the maintenance of the standards for these pollutants would be ensured until after 1985. The projections demonstrate attainment of the CO and oxidant standards in 1980 and 1982, respectively, without additional measures.

D. Sources Contributing to Standard Violations

Since stationary hydrocarbon sources are already under control by EPA, and mobile sources are the prime contributor to the emissions of CO, the latter were the object of the development of control measures. Since light duty vehicles comprised the major sector of mobile sources, this source sector was singled out for major attention.

The projected particulate air quality and the percentage contributions from each source sector indicated that point sources, under current regulations, contribute only to a small degree to the measured concentrations of particulates. The contributions from area and fugitive sources are comparable and represent the majority of the emissions contributing to the increased level of particulates.

E. Level of Emission Control

The level of restraint on emissions needed to maintain the NAAQS immediately followed from the projection of emissions and the determined allowable levels for CO and HC and from the projected air quality of particulates. The proportional rollback equation was used to determine the needed percentage reduction of projected emission levels.

F. Problems

Although the most detailed projections of growth available were used for projecting the emissions and thereby the air quality, there can be no guarantee that all areas within a zone will grow at the same rate or that the modeling sufficiently portrays the air quality concentrations in the modeling area. Therefore, it must be recognized that the possibility of "hot spots" of air pollution exist and that, to prevent their occurrence, continuing review of development activities is necessary.

VII. Selection of Maintenance Strategies

A. The Need for Attainment

The above air quality projections indicated that the primary problem was not in the maintenance of air quality during the 10-year period, but attainment of the standards. Basically, if the standards are attained, the maintenance will follow without additional effort. Since the projections took into account the current and scheduled emission controls, it was necessary to consider additional attainment strategies to provide the needed attainment of standards. The attainment measures are primarily directed at the control of emissions themselves or the reduction of the number of certain types of sources. This differs from the maintenance measures that are aimed at controlling the amount of growth or the location of the growth.

This study was not intended to provide a detailed analysis and development of any needed attainment measures; however, some were presented and discussed. These centered on the implementation of available travel-reduction measures (e.g., bus service, carpooling, 4-day work weeks) for the motor vehicle related pollutants. For fugitive dust, more stringent dust control measures were suggested. No analysis of the proposed travel-reduction measures was possible and the application of more stringent fugitive dust regulations demonstrated that the secondary standard for particulates would still not be met.

B. The Example AQMP

Air quality maintenance for the Denver Front Range Air Quality Maintenance Study Area depends primarily on assurance that the growth projections used for projecting activity in the metropolitan Denver area will not be exceeded. It must be remembered that the assumption inherent in the data base and projection factors used in the development of the AQMP become integral parts of the AQMP and any changes in the base or the factors could significantly change the validity of the AQMP. It is therefore necessary to consciously incorporate the assumptions of the projection factors into the plan.

For the Denver metropolitan region, the JRPP projections of population, employment, and VMT were used. These projections assumed a particular controlled growth rate of population and land use, partially influenced by a mass transit system being developed by the Regional Transportation District. Therefore, the maintenance measures proposed were simply those directed toward ensuring the institutionalization of the JRPP plan:

1. Construction of the RTD rapid transit system
2. Construction of the JRPP highway system
3. Construction and indirect source review compatible with the JRPP land use and transportation plan
4. Development of activity centers as proposed by the JRPP
5. Use of the land use development permit system to complement the air quality permit system.

C. Factors Pertinent to the AQMP Selection

As this plan was developed by JRPP, a joint cooperative effort of the highway, mass transit, and local government authorities, most of the factors that normally need to be evaluated have already been considered by the JRPP.

1. Socioeconomic

In the selection of the maintenance plan for the Denver AQMA, a major constraint variable was the existing social, economic, political, and legal nature of the region. By choosing the JRPP plan as part of the maintenance strategy package it is felt that this constraint condition is met.

The JRPP plan involves transportation, land use, and highway plans. For each of these, studies were done to gauge the socioeconomic effects that would result from the plan implementation. Although no final decision as to exactly what is involved in the RTD transportation plan has been made, all of the alternatives are being viewed in light of both the social system and the economic system. Features being looked at in the social system include accessibility, service to transit dependents, intrusion on private space, and changes in the stability of the neighborhoods affected. Economic considerations include transportation cost savings, energy consumption, job creation due to system construction, and impacts on business establishments during and after construction.

Activity center creation and the highway plan also are based upon socioeconomic input. Activity centers will serve to relieve growth pressures from the urban fringe. Input from citizens presently living in areas proposed as activity centers has been gathered through a series of open meetings. Comments of both residents and entrepreneurs in these locales have been obtained. The highway plan is designed to absorb future increases in automobile travel. Public hearings provide citizen input.

2. Policital Effects

The political effects of the maintenance package are slight because of the nature of the JRPP. Since DRCOG is involved in the plan creation, and since it is an organization of sub-state governmental units, agreement is contingent upon political acceptability.

Indirect source review, as well, presents no political obstacles since it is a necessity by law already legislated in Colorado. Land development permits are the only feature of the maintenance strategy package that may involve political acceptance problems. Land use legislation has been slow in evolving and a majority of power still resides at the municipal level. Modification of the existing interfacing structure to provide more authority to the state agencies will most easily be accomplished on a cooperative basis with the local levels.

3. Technical Feasibility

The technical feasibility of the transportation system has not yet been fully demonstrated at this time as it is still in the planning stage. The feasibility, or lack thereof, will be demonstrated in time for the development of the actual AQMP for this region.

4. Political Acceptance

The public acceptance of such a plan is an on-going goal of the developers. Acceptance must be pursued at every step through the development and implementation of the plan. Current feeling is that this system has a high potential for continuing public acceptance due to the interest of Coloradans in the preservation of the environment and the possibility of increasing personal transit costs.

D. Implementation Obstacles

Given the continued public acceptance and a demonstrated technical feasibility, there should be no major implementation obstacles for the RTD mass transit plan. Activity centers are assumed to follow, to a large extent, the corridors of the transit system.

Some major obstacles of permit review authority may arise if the Colorado Air Pollution Control Commission demands that it be given veto authority as may be required by the Federal regulations. Although it may be possible to provide a cooperative working review, it is not certain that this will meet with the approval of the EPA.

VIII. Legal Authority

A. Necessary Authority

The legislation necessary to carry out an air quality maintenance plan includes a strong air pollution control act and land use legislation which at least addresses the question of air quality. Ideally such legislation should include two features. First, it should provide some delineation of decision making power, attempting to identify the extent of such power for each feature covered in the legislation. Secondly, the laws should cover those areas germane to air quality maintenance.

B. Available Authority

Legislation available in Colorado to carry out an air quality maintenance plan includes the following pieces of major legislation.

1. Air Pollution Control Act of 1970
2. Land Use Act
3. House Bill 1041 which amended the Land Use Act.

The Air Pollution Control Act created the nine-member Colorado Air Pollution Control Commission to develop an effective air pollution control program and promulgate such regulations as may be necessary or desirable to "achieve the maximum prictical degree of air purity in every portion of the state." The regulations especially applicable to air quality maintenance follow.

1. Regulation No. 3: Regulation Governing Authority to Construct and Permit to Operate
2. Regulation No. 6: Standards of Performance for New Stationary Sources
3. Regulation No. 9: The Control of Automotive Air Pollution through Motor Vehicle Restraints and the Encouragement of Public Transportation and Carpooling.

The Land Use Act as amended provides for a Land Use Commission to provide leadership for planned and orderly land use development. To this end the Commission has worked at providing a framework whereby the State of Colorado and its political subdivisions can guide future development. Municipal decisions regarding land use are fostered by this legislation. As it stands now air quality is not addressed in the legislation. From a maintenance standpoint, this is the major deficiency of the law.

C. Additional Authority Required

A comparison of the legal foundation necessary for a viable air quality maintenance plan with the existing legislation and regulation brings out two salient features. First, air quality should be explicitly considered in land use planning. The Land Use Act should be so amended. Secondly, some legislation or even an executive order should provide for the coordination between the Air Pollution Control Commission and the Land Use Commission. As it now stands, there is no formalized information flow between the two.

SUMMARY OF DENVER AQMSA

POLLUTANT: TSP[*]

NAAQ STANDARD: 60 $\mu g/m^3$ annual geometric mean

CURRENT AIR QUALITY, 3-year average, 1970-72: 130 $\mu g/m^3$ annual geometric mean

EXPECTED AIR QUALITY IN 1975: 114 $\mu g/m^3$ annual geometric mean

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD: 70%

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

Stricter fugitive dust controls - 1975

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED:

None additional.

---

[*] Background at 30 $\mu g/m^3$ assumed.

SUMMARY OF DENVER AQMSA

POLLUTANT: CO

NAAQ STANDARD: 10 $\mu g/m^3$ (8-hour average)

CURRENT AIR QUALITY, 1971: 31.6 $\mu g/m^3$ (8-hour average)

EXPECTED AIR QUALITY IN 1975/1977: 26 $\mu g/m^{3*}$/14 $\mu g/m^{3*}$

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD: 68%

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

Attainment Measures

I. Preferential Treatment of Buses
  A. Exclusive Bus-Carpool Lanes
    1. feasibility study (September 1, 1974)
    2. plan submission (July 1, 1975)
    3. plan implementation — January 1, 1976
  B. Park-N-Ride Facilities/Express Buses to CBD
    1. plan submission (October 1, 1974)
    2. plan implementation — (est.) January 1, 1976

II. Employer Plan Requirements for Carpooling and Mass Transit Incentives
  A. Carpooling
    1. DRCOG proposal for carpool locator service (November 1, 1974)
    2. Employer submittal of affidavit stating that DRCOG locator service will be provided to employees or that another locator service of equal or greater effectiveness will be used.
       large employers (>250 employees) submitted (February 1, 1975)
       other employers (50-250 employees) submitted (August 1, 1975)
    3. Plan Implementation
       large employers — April 1, 1975
       other employers — October 1, 1975
  B. Mass Transit Incentives
    1. large employers plan submittal — (February 1, 1975)
    2. other employers plan submittal — (August 1, 1975)

III. Parking Requirements
  DRCOG recommendations of parking requirements that may stimulate the use of public transportation and decrease single passenger VMT (March 1, 1975)

Maintenance Measures

1. Construction of the RTD rapid transit system — 1983
2. Construction of the JRPP highway system — ongoing
3. Construction and indirect source review compatible with JRPP land use and transportation plan —(policy statement by July 1, 1975) - ongoing

Maintenance Measures (continued)

4. Development of activity centers as proposed by the JRPP - 1983
5. Use of land use development permit system to complement air quality permit system - ongoing

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED:

Attainment

For the preferential treatment of buses RTD, working with the Colorado Department of Highways and DRCOG, must submit a detailed plan to the APCC. The other two maintenance strategies require DRCOG, with the aid of the CDH and RTD, to perform analyses and make formal reports to the APCC.

Maintenance

The maintenance strategy package requires the APCC and the LUC to exchange information and coordinate efforts related to air quality maintenance through periodic meetings. The progress of the JRPP plan will be monitored by the APCC through reports from the involved agencies. The LUC will work with municipal government units in the operation of the permit system.

SUMMARY OF DENVER AQMSA

POLLUTANT: NO_x

NAAQ STANDARD: 100 $\mu g/m^3$ annual arithmetic mean

CURRENT AIR QUALITY, 1972: 73 $\mu g/m^3$ annual arithmetic mean

EXPECTED AIR QUALITY IN 1975: 70 $\mu g/m^3$* annual arithmetic mean

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD: None needed.

PROPOSED ATTAINMENT/MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

None required.

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED:

---

[*] No modeling involved, only proportionality techniques.

SUMMARY OF DENVER AQMSA

POLLUTANT: HC/Photochemical Oxidants

NAAQ STANDARD: 160 $\mu g/m^3$, 3-hr concentration (6 to 9 a.m.)

CURRENT AIR QUALITY, 1973: 490 $\mu g/m^3$, 3-hr concentration (6 to 9 a.m.)

EXPECTED AIR QUALITY IN 1975/1977: 455 $\mu g/m^3$/ 307 $\mu g/m^3$*

PERCENTAGE REDUCTION NEEDED TO ATTAIN STANDARD: 67%

PROPOSED ATTAINMENT MAINTENANCE MEASURES AND DATE THEY MUST BE IN EFFECT:

Same as carbon monoxide strategies.

INTERGOVERNMENTAL RELATIONSHIPS REQUIRED:

Same as carbon monoxide strategies.

---

*No modeling involved, only proportionality techniques.